

TO 36A10-3-29-31

TECHNICAL MANUAL

**OPERATION AND OPERATOR
MAINTENANCE INSTRUCTIONS**

**FLIGHTLINE
TOW TRACTOR
MODEL NO. 3**

NSN 1740-01-173-0520YW

PSI Mobile Products, Inc.
F09603-84-C-0306
F09603-99-D-0382

BASIC AND ALL CHANGES HAVE BEEN MERGED TO MAKE THIS A COMPLETE PUBLICATION

DISTRIBUTION STATEMENT - Distribution authorized to U.S. Government Agencies and their contractors (Administrative or Operational Use) (15 August 1984). Other request for this document shall be referred to WR-ALC/LEET, Robins AFB, GA 31098. Questions concerning technical content shall be referred to WR-ALC/LESV.

WARNING - This document contains technical data whose export is restricted by the Arms Export Control Act (Title 22, U.S.C., Sec. 2751 *et seq.*) or the Export Administration Act of 1979, as amended Title 50, U.S.C., App. 2401 *et seq.* Violators of these export laws are subject to severe criminal penalties. Disseminate in accordance with provisions of DoD Directive 5230.25.

HANDLING AND DESTRUCTION NOTICE - Comply with distribution statement and destroy by any method that will prevent disclosure of contents or reconstruction of the document.

Published Under Authority of the Secretary of the Air Force

15 AUGUST 1984

CHANGE 5 - 3 JANUARY 2005

LIST OF EFFECTIVE PAGES

INSERT LATEST CHANGED PAGES. DESTROY SUPERSEDED PAGES.

NOTE: The portion of the text affected by the changes is indicated by a vertical line in the margins of the page. Changes to illustrations are indicated by miniature pointing hands. Changes to wiring diagrams are indicated by miniature pointing hands or by shaded areas. A vertical line running the length of a figure in the outer margin of the page indicates that the figure is being added.

Dates of issue for original and changed pages are:

Original	0	15 August 1984	Change.....	3	18 September 1995
Change.....	1	15 February 1989	Change.....	4	30 August 2002
Change.....	2	30 July 1993	Change.....	5	3 January 2005

TOTAL NUMBER OF PAGES IN THIS PUBLICATION IS 46, CONSISTING OF THE FOLLOWING:

Page No.	*Change No.
Title	5
A.....	5
i	5
ii	0
iii	1
iv	0
v	1
vi Blank	0
1-1	1
1-2 - 1-3	0
1-4	4
1-5	1
1-6 - 1-9	0
1-10	1
1-11 - 1-12	0
1-13	1
1-14 Added.....	1
2-1 - 2-4	1
2-5 - 2-8	5
3-1 - 3-5	0
3-6	1
3-6.1 Added	1
3-6.2 Blank Added.....	1
3-7	1
3-8 - 3-10	2
3-11	0
3-12 - 3-14	1

*Zero in this column indicates an original page.

TABLE OF CONTENTS

Chapter		Page
LIST OF ILLUSTRATIONS.....		iii
LIST OF TABLES.....		iv
INTRODUCTION		v
1 DESCRIPTION.....	.....	1-1
1-1 Purpose of Equipment		1-1
1-2 General Description.....		1-1
1-3 Detailed Description.....		1-5
1-3.1 Chassis and Body		1-5
1-3.2 Engine		1-5
1-3.3 Transmission.....		1-5
1-3.4 Transfer Case.....		1-5
1-3.5 Front Axle.....		1-5
1-3.6 Rear Axle.....		1-5
1-3.7 Brakes		1-5
1-3.8 Steering System		1-5
1-3.9 Electrical System.....		1-10
1-3.10 Cooling System.....		1-10
1-3.11 Fuel System		1-10
1-3.12 Exhaust System.....		1-10
1-3.13 Air System		1-10
1-3.14 Winterization System.....		1-10
2 OPERATION.....	.....	2-1
2-1 General		2-1
2-2 Safety Precautions		2-1
2-3 Principles of Operation.....		2-3
2-4 Controls and Indicators.....		2-3
2-4.1 Equipment Familiarization		2-3
2-4.2 Gauges and Instruments.....		2-4
2-4.3 Supplemental Equipment Operation.....		2-4
2-5 Starting the Equipment		2-5
2-5.1 Prestart Checks		2-5
2-5.2 Starting Engine		2-5
2-5.3 Post-Start Checks.....		2-5
2-6 Normal Operation.....		2-5
2-6.1 Mobile Operation.....		2-6
2-6.2 Description of Extendable Hitch Function		2-6
2-6.3 Towing Operation.....		2-6
2-7 Operation Under Unusual Conditions		2-7
2-7.1 Extreme Heat		2-7
2-7.2 Extreme Cold.....		2-7
2-7.3 Humid Climates.....		2-7
2-7.4 Dusty Conditions.....		2-7
2-8 Stopping the Equipment		2-7
3 OPERATIONAL INSPECTION, MAINTENANCE AND LUBRICATION .....	.....	3-1
3-1 Introduction		3-1
3-2 Troubleshooting.....		3-1
3-3 Operator Inspection		3-6
3-4 Operator Maintenance and Servicing		3-6

TABLE OF CONTENTS (Continued)

Chapter		Page
3-4.1	Lubrication	3-6
3-4.2	Battery Maintenance	3-6
3-4.3	Windshield Fluid Level.....	3-12
3-4.4	Coolant Level.....	3-12
3-4.5	Engine Oil Level	3-12
3-4.6	Transmission Fluid Level.....	3-12
3-4.7	Drive Belts.....	3-13
3-4.8	Tires and Wheels.....	3-13
3-4.9	Windshield Wiper Replacement.....	3-14
3-4.10	Air Reservoir Check	3-14
3-4.11	Water Separator Check	3-14
3-4.12	Exterior Care.....	3-14

LIST OF ILLUSTRATIONS

Number	Title	Page
1-1	Flightline Tow Tractor	1-1
1-2	Major Vehicle Components	1-2
1-3	Engine and Transmission Assembly.....	1-6
1-4	Brake System	1-8
1-5	Steering System	1-9
1-6	Cooling System.....	1-11
1-7	Fuel System	1-12
1-8	Air System Arrangement	1-13
1-9	Winterization System Arrangement.....	1-14
2-1	Tractor Controls and Instruments	2-2
3-1	Lubrication Chart	3-8
3-2	Checking Battery Specific Gravity.....	3-11
3-3	Cleaning Battery Posts	3-11
3-4	Cleaning Cable Terminals.....	3-11
3-5	Windshield Fluid Reservoir.....	3-12
3-6	Cooling System.....	3-12
3-7	Oil Level Indicators	3-12
3-8	Engine Oil.....	3-13
3-9	Transmission Fluid Level Indicators	3-13
3-10	Transmission Fluid - Add	3-13
3-11	Drive Belt Tension Test	3-13
3-12	Tire Tread Wear Indicators	3-13
3-13	Windshield Wiper Blade Replacement.....	3-14
3-14	Air Reservoir Check	3-14
3-15	Water Separator.....	3-14

LIST OF TABLES

Number	Title	Page
1-1	Systems and Components Specifications	1-3
1-2	Engine Performance Specifications.....	1-7
3-1	Operator's Troubleshooting Table	3-1
3-2	Operator's Inspection Table	3-7

INTRODUCTION

PURPOSE.

This publication presents operator instructions for the Flightline Tow Tractor, Model 3. This vehicle has been manufactured by PSI Mobile Products, Mt. Clemens, Michigan 48043.

SCOPE.

This manual provides a general description of the Flightline Tow Tractor as well as its major components and their functions. This manual also provides safety precautions, operating procedures and instructions for inspection, maintenance and lubrication procedures to be performed by the operator.

RELATED TECHNICAL MANUALS.

The Air Force manuals related to the Operation and Operator Maintenance Instructions are listed below:

TO 36A10-3-29-32

Maintenance/Overhaul Instructions,
Flightline Tow Tractor, Model No. 3

TO 36A10-3-29-34

Illustrated Parts Breakdown,
Flightline Tow Tractor, Model No. 3

Chapter 1 DESCRIPTION

1-1 PURPOSE OF EQUIPMENT.

The USAF Flightline Tow Tractor, Model No. 3, (figure 1-1), is a diesel engine driven, four wheel, two-rear wheel drive vehicle. It is based on a commercial truck chassis and cab. The vehicle is designed to tow trailers, ground support equipment and other wheeled loads on runways, in and around warehouses, loading platforms and docks. It is capable of producing 4000 pounds (1816 kg) drawbar pull and of pulling trailing wheeled loads of up to 40,000 pounds (18,160 kg) on level surfaces, 25,000 pounds (11,350 kg) on 3% grades and 20,000 pounds (9080 kg) on 5% grades at a minimum speed of 10 mph (16 kph). top forward speed of vehicle is 25 mph (40 kph). The flightline tow tractor can perform all of its designed functions in ambient temperatures ranging from -25°F to +125°F (-32°C to +51°C).

1-2 GENERAL DESCRIPTION.

The Flightline Tow Tractor, Model No. 3 (figure 1-2), consists of a standard commercial truck chassis and cab with a shortened wheel base. In addition, a flood-light, towing devices, trailer brake air system (when provided), trailer electrical receptacle, ballast, winterization system, and tool/cargo box have been added. References to the right-hand side and left-hand side of the tractor are made with respect to viewing the vehicle from the rear. The vehicle consists of 13 major systems and components. Refer to table 1-1 for performance, systems and components specifications.

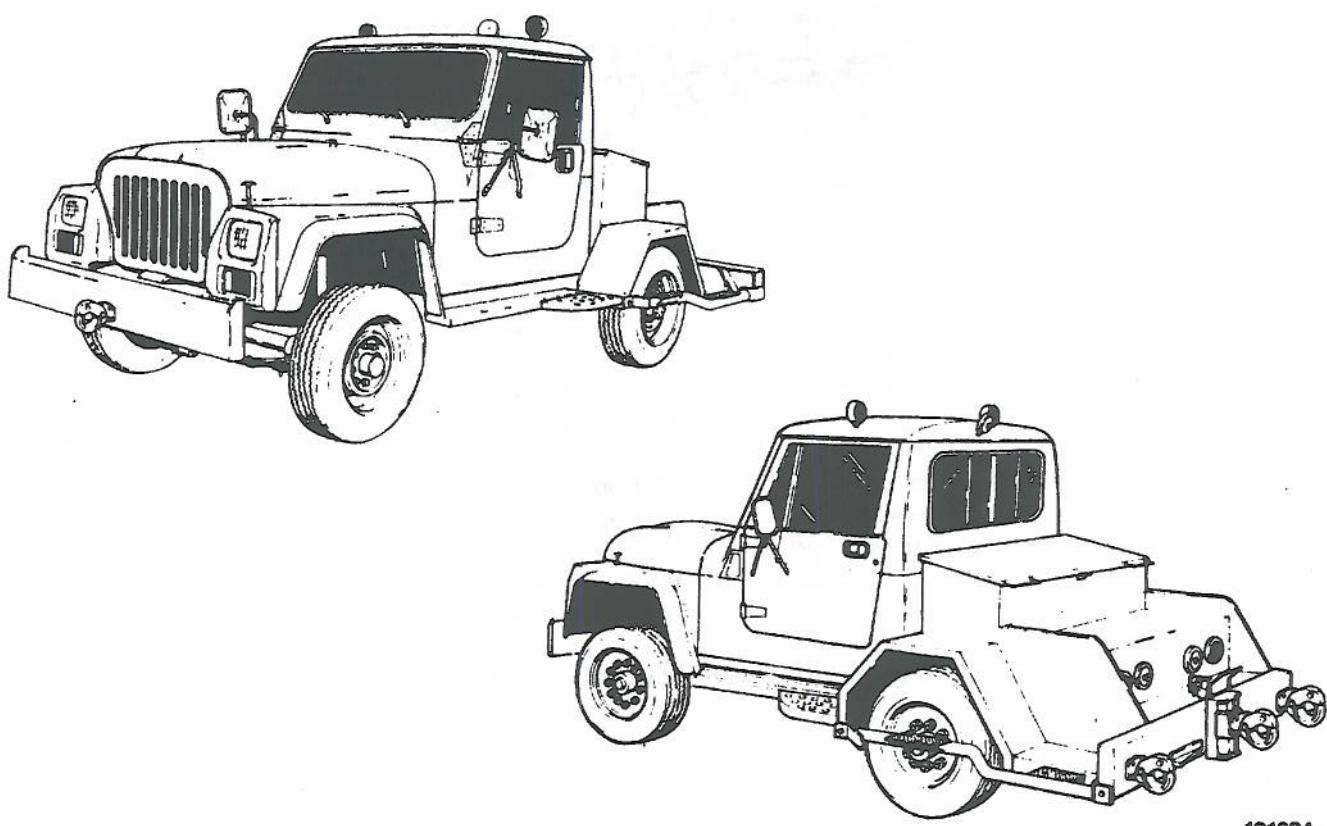
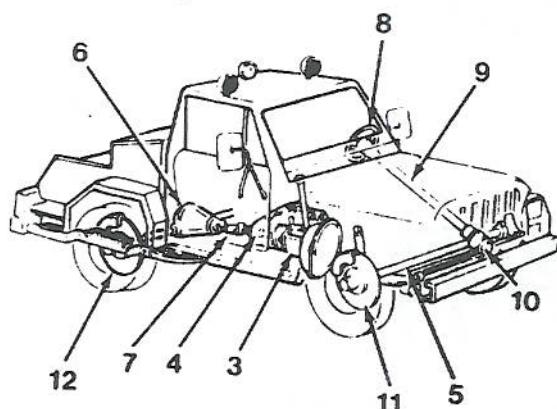
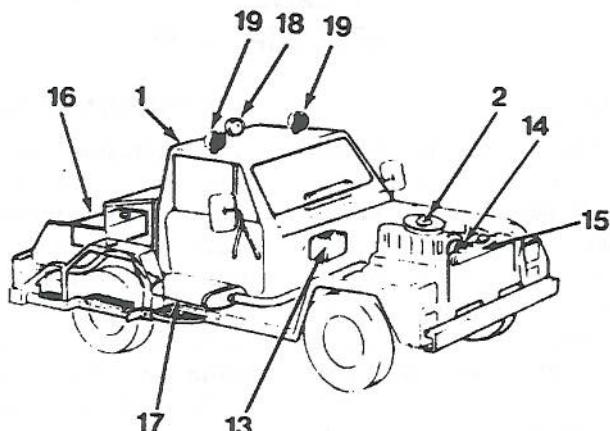


Figure 1-1. Flightline Tow Tractor

10138A



10165A

- | | |
|--------------------|-----------------------|
| 1. Cab | 10. Steering Gear |
| 2. Engine | 11. Front Disc Brakes |
| 3. Transmission | 12. Rear Drum Brakes |
| 4. Transfer Case | 13. Battery |
| 5. Front Axle | 14. Alternator |
| 6. Rear Axle | 15. Radiator |
| 7. Propeller Shaft | 16. Fuel Tank |
| 8. Steering Wheel | 17. Muffler |
| 9. Steering Column | 18. Work Light |
| | 19. Warning Lights |

Figure 1-2. Major Vehicle Components

Table 1-1. Systems and Components Specifications

GENERAL

Vehicle Type	USAF Flightline Tow Tractor, Model No. 3
National Stock Number	1740-01-173-0520-YW
Overall Length	170 inches
Width	94 inches
Height	78 inches
Curb Weight	6000 pounds
Ground Clearance	6.5 inches
Fuel Tank Capacity (Diesel Fuel)	20 gallons (75.6 liters)

PERFORMANCE

Operating Temperature Range, Ambient	-25°F to +125°F
Maximum Speed	25 mph
Maximum Drawbar Pull	4000 pounds
Maximum Towed Load	
Level Ground	40,000 pounds
3% Grade	25,000 pounds
5% Grade	20,000 pounds

CHASSIS AND BODY

Type	Modified AMC CJ-10A
Cab	Automotive Type with Split Bench Seat
Tool/cargo Box Displacement	11.47 cubic feet
Front Towing Hitch	Pintle Type, Fixed
Rear Towing Hitch	Pintle Type, One Extendable (one person hookup), Two Fixed

ENGINE

Type	4 Cycle Diesel
Model	Nissan SD-33
Oil Capacity (quarts)	7.9
Oil Capacity (litres)	7.5
Number of Cylinders	6
Bore (inches)	3.268
Bore (mm)	83
Stroke (inches)	3.94
Stroke (mm)	100
Compression Ratio	20.8 to 1
Total Displacement (litres)	3.3
Number of Main Bearings	4

TRANSMISSION

Type	Full Automatic
Model	Chrysler Model 727
Fluid Capacity (pints)	8.5
Fluid Capacity (litres)	4.0
Range Selector Positions	P (PARK), R (REVERSE), N (NEUTRAL), D (DRIVE), 2 (DRIVE 2), 1 (DRIVE 1)

Table 1-1. Systems and Components Specifications (Continued)

Gear Ratios		
First .....	.....	2.45 to 1
Second .....	.....	1.45 to 1
Third .....	.....	1.00 to 1
Reverse .....	.....	2.20 to 1
TRANSFER CASE		
Model .....	.....	Modified AMC Model 198
Reduction Ratio .....	.....	2.61 to 1
Fluid Capacity (pints) .....	.....	6.0
Fluid Capacity (litres) .....	.....	2.8
FRONT AXLE		
Type .....	.....	Steering, Non-Driving
Model .....	.....	Dana #44DF
REAR AXLE AND DIFFERENTIAL		
Type .....	.....	Driving, Full Float
Model .....	.....	Dana Model 70 24
Reduction Ratio .....	.....	4.88 to 1
Differential		
Type .....	.....	Hypoid Limited Slip
Lubricant Capacity (pints) .....	.....	6.75
Lubricant Capacity (litres) .....	.....	3.2
WHEELS		
Size .....	.....	16.5 x 6.75
TIRES		
Type .....	.....	Tubeless, Bias Ply
Size .....	.....	8.00 x 16.5
Ply Rating .....	.....	8
Pressure .....	.....	Rear Tires 75 psi Cold Front Tires 55 psi Cold
BRAKE SYSTEM		
Type .....	.....	Vacuum Assisted Hydraulic
Front Wheel Brakes .....	.....	Disc
Rear Wheel Brakes .....	.....	Drum
STEERING SYSTEM		
Type .....	.....	Hydraulically Assisted, Variable Rotation
Ratio .....	.....	13/16 to 1
AIR COMPRESSOR		
Model .....	.....	Nissan Model 92600-90000
Capacity .....	.....	CFM
WINTERIZATION SYSTEM (engine compartment)		
Heater, Oil, Engine		
Model .....	.....	Phillips-Temro Model 8500371
Voltage .....	.....	115 VAC
Heater, Coolant, Engine		
Model .....	.....	Phillips-Temro Model 8500045
Voltage .....	.....	115 VAC
Heater, Blanket, Battery		
Model .....	.....	Phillips-Temro Model 8500320
Voltage .....	.....	115 VAC

1-3 DETAILED DESCRIPTION.

The following components and systems comprise the major divisions of the flightline tow tractor. Each major component/system contained in the vehicle is described in the following paragraphs.

1-3.1 Chassis and Body. The chassis and body contain all components with the exception of those associated with the power plant.

1-3.1.1 Chassis. The chassis consists of a three-speed automatic transmission, a chain drive transfer case with a rear output shaft, a rear propeller shaft, front and rear axles, a hydraulic brake system and a power steering gear and pump. Other components of the chassis include four wheels and tires, steering column, steering linkage and leaf spring suspension.

1-3.1.2 Body. The body consists of body and frame components and is of all steel construction. Insulated mounting points are provided for secure attachment of body to frame. All major body panels, such as hoods and doors, are of heavy gauge steel, reinforced, flanged and welded. The body is completely detachable from the chassis and insulated from the frame by body spacers. These insulate against vibrations and road noise. Other components which make up the body include the hardtop enclosure, seat assembly, rear window, lighting systems, horn system and windshield wipers. The frame is the foundation and structural center of the vehicle. It is constructed of heavy-channel-steel side rails and crossmembers. The crossmembers maintain the proper position of the side rails in direct relationship to each other, providing maximum resistance to torsional twist and strains.

1-3.2 Engine. The engine (figure 1-3) is a four-cycle, six cylinder, in-line, swirl combustion chamber diesel engine. Listed below are some of the components and features of the engine. Table 1-2 lists engine performance specifications.

1-3.2.1 Spherical-Swirl Combustion Chamber. A spherical-swirl combustion chamber contributes to rapid and effective combustion of the air/fuel mixture and to quiet operation, easy starting and fuel economy.

1-3.2.2 Glow Plugs. Glow plugs are installed at each cylinder to promote quick starts under cold operating conditions.

1-3.2.3 Replaceable Cylinder Liners. The dry-type cylinder liners are replaceable, improving serviceability and long engine life.

1-3.2.4 Lubrication. A full-flow oil filter and large oil cooler extend intervals between oil changes and maintain proper oil temperature. Oil jets cool the pistons.

1-3.2.5 Piston Rings. The piston rings are hard chromium plated to improve wear resistance.

1-3.2.6 Vibration Dampening. A rubber damper is attached to the end of the crankshaft to absorb torsional vibration.

1-3.2.7 Vacuum Pump. A rotary-vane-type pump generates vacuum for the power brake unit and other systems. The pump is driven on the same shaft as the alternator.

1-3.3 Transmission. The automatic transmission (figure 1-3) used in the vehicle is a fully automatic, three-speed, hydraulically operated unit with a compound planetary gear system. A manually operated gearshift linkage is used to select the desired gear range. Gear selection is made by using the control lever on the steering column. The shift points on this model range with throttle opening.

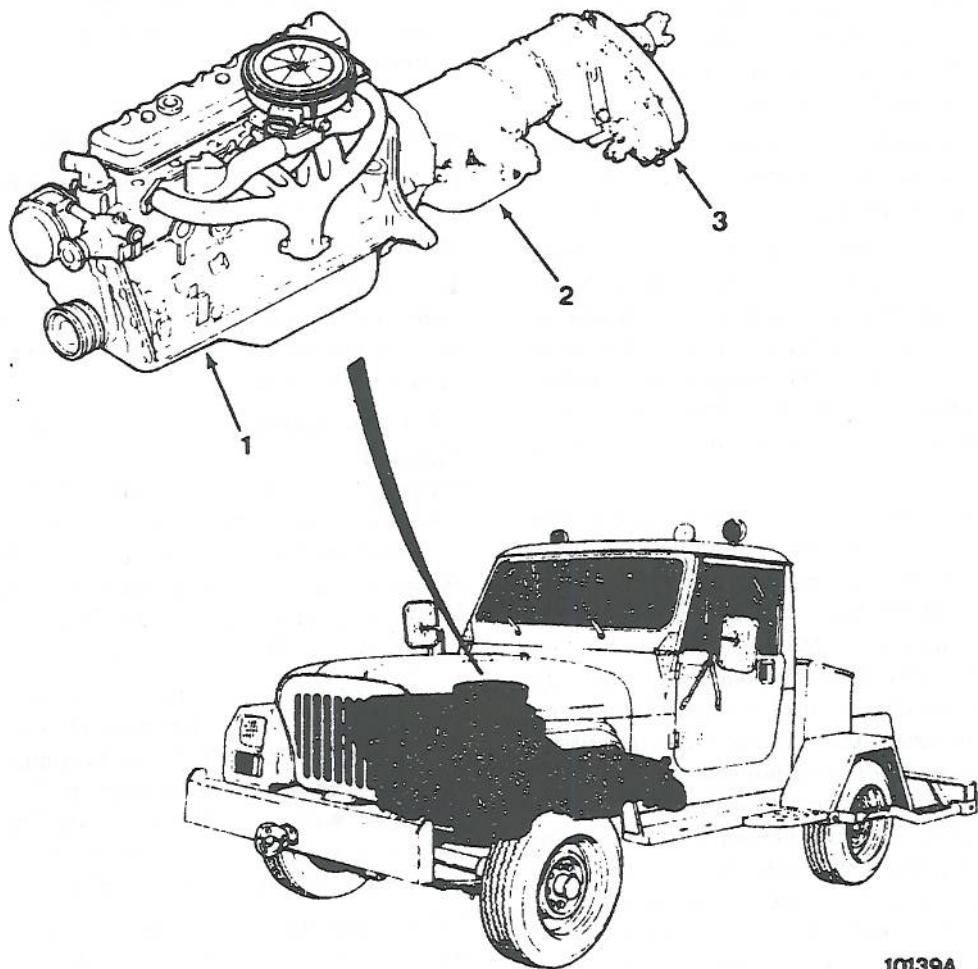
1-3.4 Transfer Case. The transfer case (figure 1-3) is a chain drive unit consisting of a two-piece aluminum case. The transfer case is mounted directly on the rear end of the transmission. The vehicle is not equipped with a reduction gear. The transfer case locks the vehicle into a low gear range which can generate a maximum speed of 25 mph.

1-3.5 Front Axle. The front axle is a non-drive type, with open-end steering knuckles mounted on ball studs. The axle has an adjustable toe-in and caster, but camber is built into the axle during manufacture and cannot be adjusted. The front axle turning angle is also adjustable.

1-3.6 Rear Axle. The rear axle transmits the torque to the rear wheels, thus providing traction.

1-3.7 Brakes. The vehicle is equipped with single-piston, low-drag, floating caliper front disc brakes (figure 1-4). A dual-reservoir master cylinder provides separate hydraulic systems for the front and rear brakes. The rear drum brakes have linkage-operated adjusters. A vacuum pump, located on the rear cover of the alternator, produces vacuum for the power brakes and other components.

1-3.8 Steering System. The power steering system (figure 1-5) forms a closed system consisting of a power steering gear, hydraulic pump and interconnecting hoses. The system fluid supply is contained in a reservoir mounted on the pump. Fluid from the pump is supplied to the gear through the interconnecting pressure and return hoses. The pump is



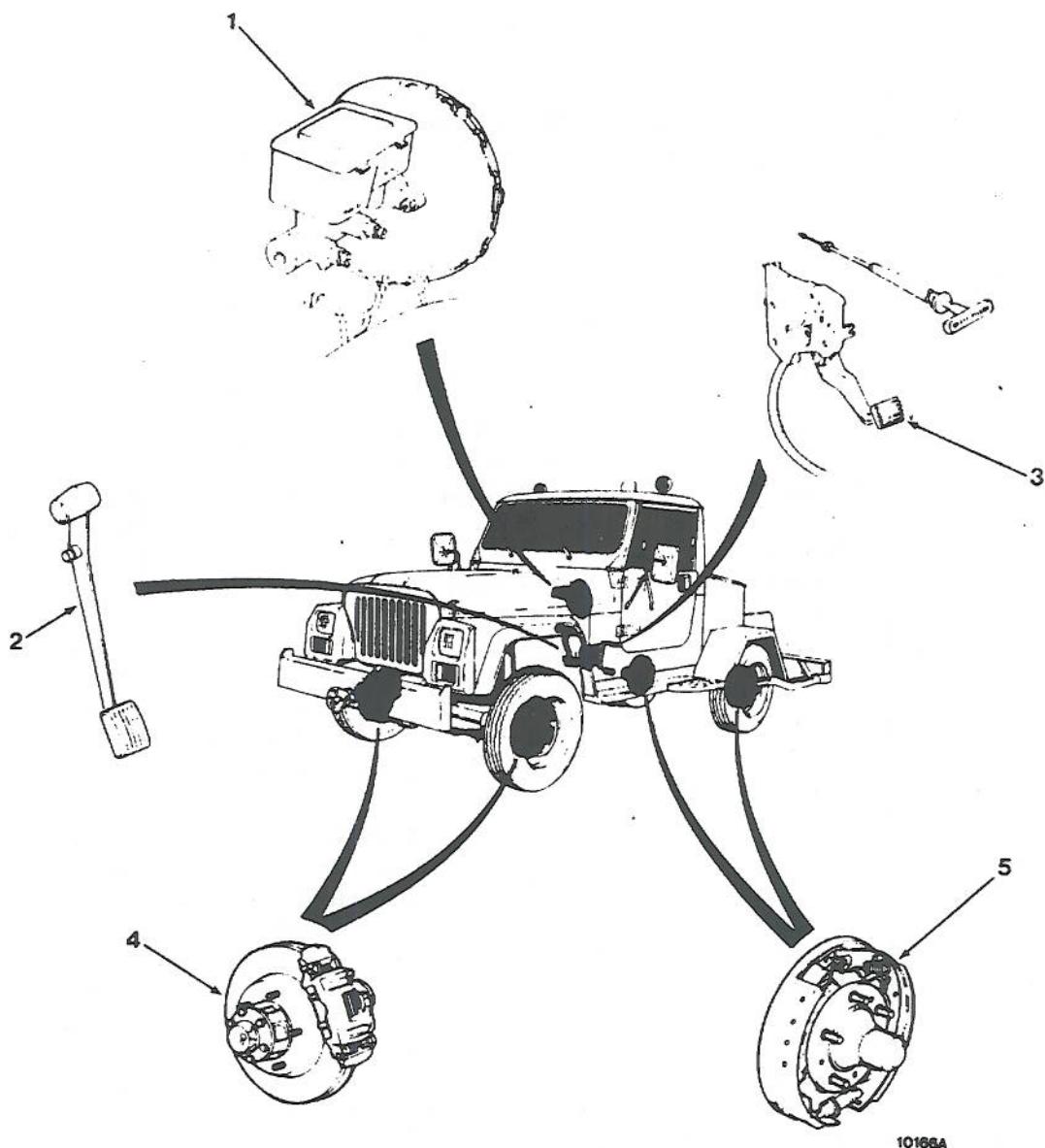
10139A

1. Engine
2. Transmission
3. Transfer Case

Figure 1-3. Engine and Transmission Assembly

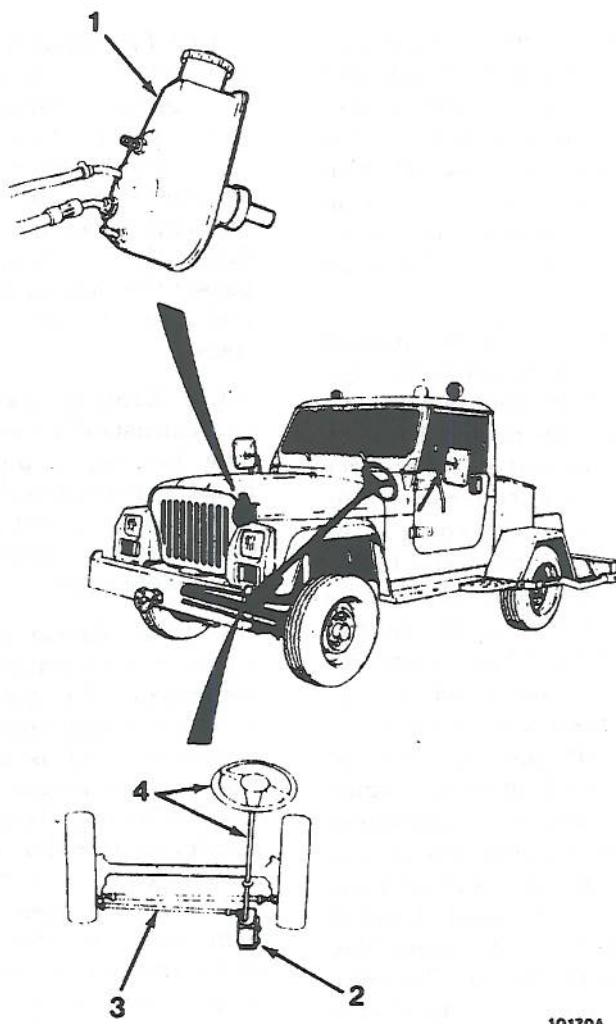
Table 1-2. Engine Performance Specifications

Item	Nominal Dimension	Maintenance Standard	Repair Limit	Remarks
Idling	rpm —	600	—	Engine as single unit. Idling speed should be stabilized.
Engine Oil Pressure	at 1500 rpm —	44.1-45.5 psi	28.4 psi	Oil temperature: 158-176°F
	at Idling —	14.223 psi	7.1 psi	
Compression Pressure	Pressure —	426.7 psi	270.2 psi	Engine rpm: 200 ± 20 rpm (warm engine)
	Difference Between Cylinders —	56.9 psi	—	
Engine Oil Consumption	h/L —	—	Less than 40% of initial value when operated under the same condition	Observe the color of exhaust fumes.
Fuel Consumption	h/L —	—	Less than 60% of initial value when operated under the same condition.	Observe the color of exhaust fumes.
Valve Timing	Inlet Valve	Open 28° B.T.D.C.	—	When valve clearance is adjusted to greater than 0.012 inch and less than 0.016 inch.
		Close 67° A.B.D.C.	—	
	Exhaust Valve	Open 67° B.B.D.C.	—	
		Close 28° A.T.D.C.	—	
Fuel Injection Timing	B.T.D.C. 20°	—	—	Measured by crank angle.



1. Master Cylinder and Power Booster
2. Brake Pedal
3. Parking Brake Pedal and Handle
4. Front Disc Brakes
5. Rear Drum Brakes

Figure 1-4. Brake System



10170A

- | | |
|------------------|------------------------------|
| 1. Steering Pump | 3. Steering Linkage |
| 2. Steering Gear | 4. Steering Wheel and Column |

Figure 1-5. Steering System

operated by a drive belt mounted on pulleys attached to the pump shaft and engine crankshaft. The power steering gear is designed to operate manually if a system malfunction should ever occur. This feature provides the driver with continued steering control of the vehicle. In this condition, the gear operates like a manual steering gear; hydraulic fluid is bypassed through the gear valve body to allow manual operation.

1-3.9 Electrical System. The vehicle is equipped with a 12-volt battery containing low-antimony-lead compound plates. In addition to helping reduce overall vehicle weight, they require less frequent electrolyte inspections, have a decreased self-discharge rate from local action and have a longer shelf life. Electrolyte level inspections are required only at the beginning of each winter season and every 15,000 miles. The negative ground alternator used has an internally mounted integrated circuit (IC) voltage regulator that is sealed in plastic. The alternator is a rotating field, three-phase AC alternator with 60 ampere output. The vehicle has a main wiring harness connector located at the left upper corner of the dash panel. This connector is made up of the engine forward lamp harness at the engine compartment side and the fuse and instrument panel harness at the passenger compartment side. The switch for the lighting system has a 24-ampere circuit breaker. The upper and lower headlamp beams are controlled by a foot switch located on the floorboard. The vehicle is equipped with a rectangular, single headlamp system. Both lamps contain two elements: one low beam and one high beam. The vehicle also contains backup lamps, a dome lamp, instrument cluster lamps, parking and directional lamps, rear directional lamps, stop lamps, and taillamps and a four-way emergency flasher. Fuses protecting the vehicle's electrical system are located in the fuse panel and bulkhead connector, located on the passenger compartment side of the dash panel. They are attached to the main harness connector. The horn system includes horn, horn relay, steering column wiring harness and horn contact.

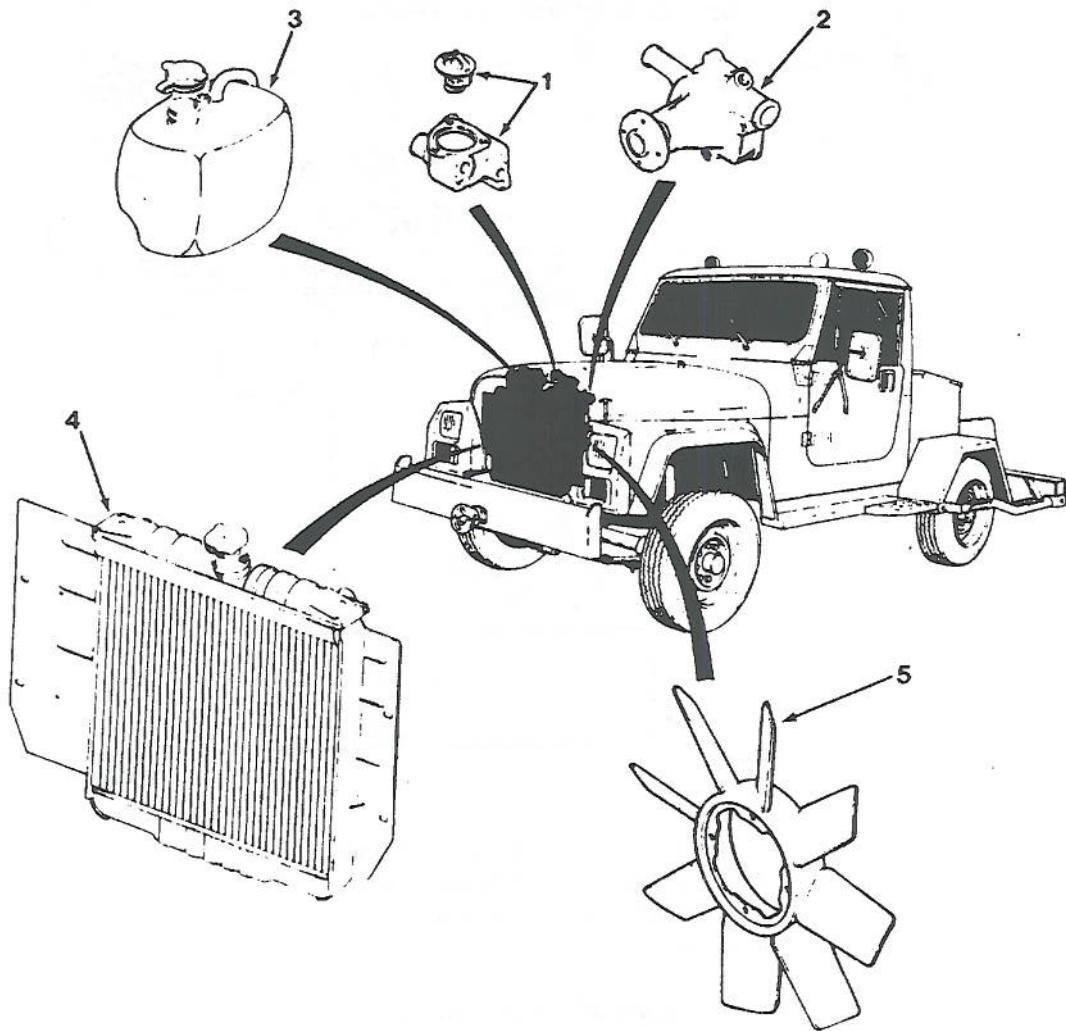
1-3.10 Cooling System. The vehicle's cooling system (figure 1-6) regulates engine operating temperature by allowing the engine to reach normal operating temperature as soon as possible, maintaining normal operating temperature and preventing engine overheating. The cooling system also provides a means of heating the passenger compartment and cooling the automatic transmission fluid. The cooling system is pressurized and uses a centrifugal water pump to circulate coolant through the system.

1-3.11 Fuel System. In the vehicle's fuel system (figure 1-7), fuel is drawn from the tank and delivered through the water separator and fuel filter to the injection pump. The injection pump feeds fuel through the nozzles to the combustion chambers. The filter overflow valve maintains specified fuel pressure and prevents excessive fuel temperature. Any excess fuel to the nozzles or to the filter overflow valve bypasses the nozzles or valves and is returned to the fuel tank. A mechanical governor controls engine speed.

1-3.12 Exhaust System. The vehicle's exhaust system consists of an exhaust manifold, front exhaust pipe, muffler, tailpipe and spark arrestor. The exhaust system must be properly aligned to prevent stress, leakage and chassis contact. If the exhaust system contacts any body panel, it may amplify objectionable noise.

1-3.13 Air System. An air compressor mounted on engine and driven by a belt off crankshaft generates air pressure for system (figure 1-8). Maximum air pressure is regulated by an adjustable air governor assembly, which is designed to unload air pressure from the compressor when pressure exceeds the adjustable limit of 100 to 125 psi. Air flows through an alcohol injector that introduces alcohol, into the air system, to prevent freeze up during cold weather. The flow continues through to the left and right hand air tanks. Both air tanks are equipped with drain valves and heaters. The left hand tank also supplies air to the governor which aids in regulating air pressure. Air from the right hand tank is split, part going to right hand side, remote shutoff valve operated, gladhand coupling (emergency side). Air from right hand tank also goes to a hand operated valve located in cab of vehicle. When this valve is opened air is allowed to flow to left hand side gladhand couplings (service side). There is also a pressure gauge located on dashboard that indicates air pressure. This system allows operator of tractor to engage air brakes on towed trailer to aid in stopping vehicle.

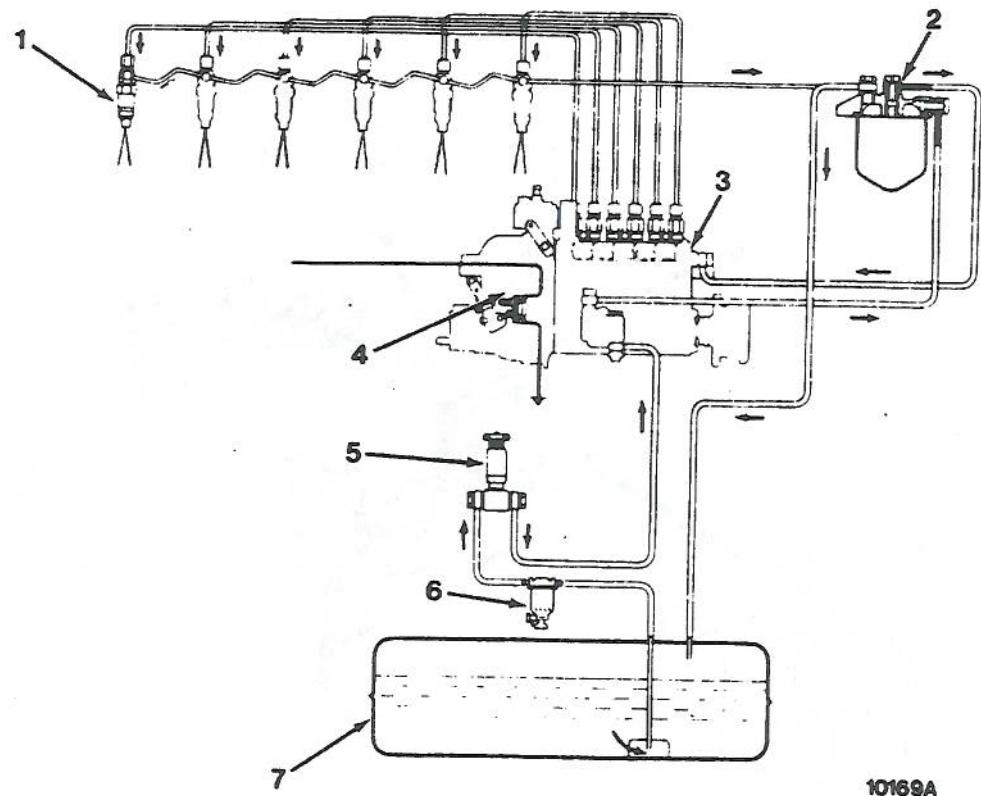
1-3.14 Winterization System. The system (figure 1-9) receives 115 VAC from an outside source that is connected to the external receptacle. Current flows to the individual components through the junction box. All components are protected from an overload by a 20 amp replaceable fuse located in the junction box. Except for battery warmer each component has a thermostat that automatically opens when maximum temperature is reached and closed when temperature drops below this limit. Once system is connected, operation is automatic and keeps coolant, engine oil, and battery warm.



10167A

- | | |
|----------------------------|-------------|
| 1. Thermostat and Housing | 4. Radiator |
| 2. Water Pump | 5. Fan |
| 3. Coolant Recovery Bottle | |

Figure 1-6. Cooling System



- | | |
|-------------------|--------------------|
| 1. Nozzles | 5. Fuel Feed Pump |
| 2. Fuel Filter | 6. Water Separator |
| 3. Injection Pump | 7. Fuel Tank |
| 4. Governor | |

Figure 1-7. Fuel System

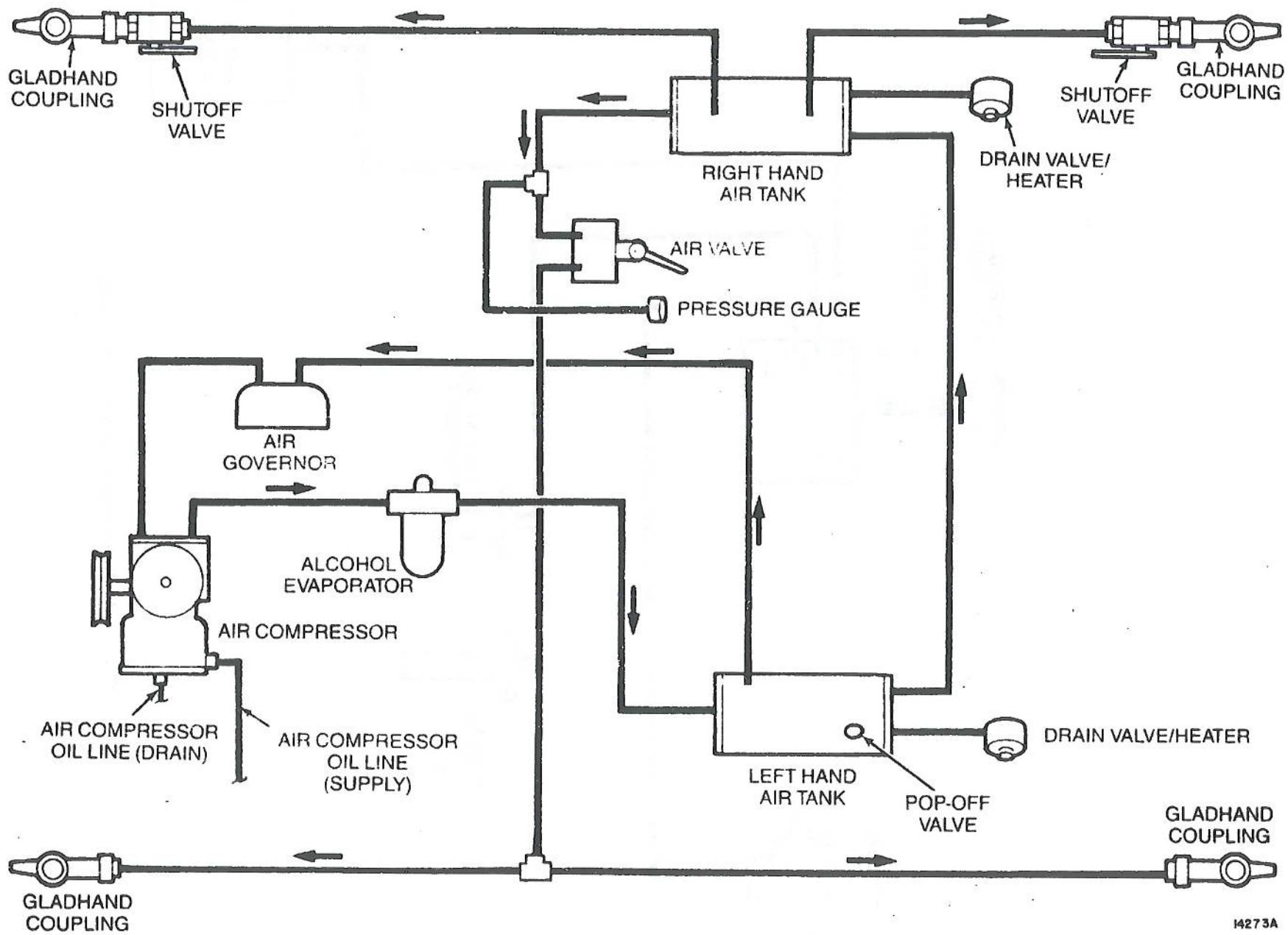


Figure 1-8. Air System Arrangement

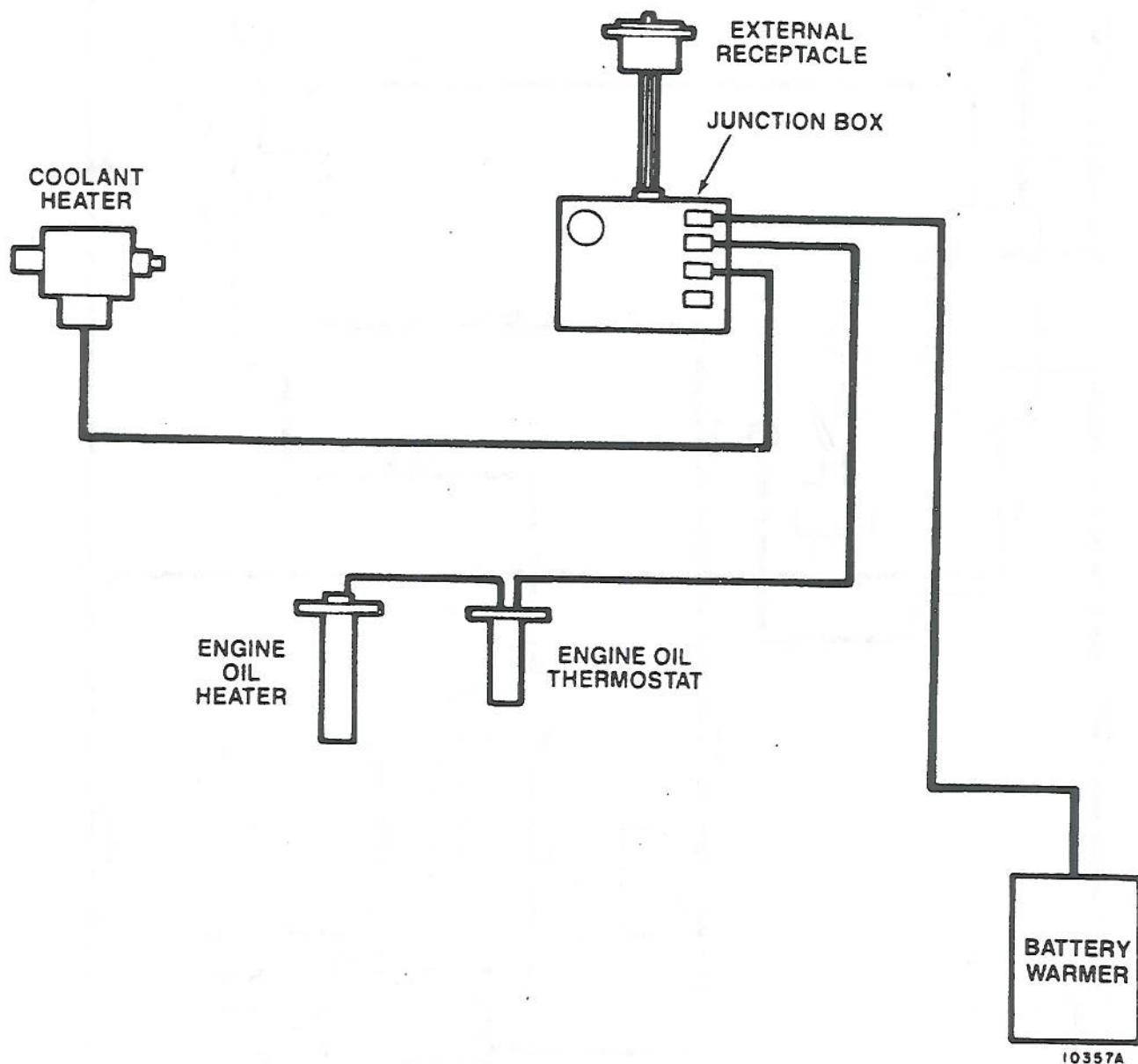


Figure 1-9. Winterization System Arrangement

Chapter 2 OPERATION

2-1 GENERAL.

This section contains information and instructions for the safe and efficient operation of the Flightline Tow Tractor, Model No. 3. Operators and maintenance personnel must be thoroughly familiar with the safety precautions, principles of operation, location and use of controls and accessories and handling characteristics of the vehicle before attempting any operation or service procedure. Only licensed and qualified personnel should attempt to operate this vehicle.

2-2 SAFETY PRECAUTIONS.

The use of powered equipment is subject to certain hazards that cannot be overcome by purely mechanical means. The exercise of intelligence, care and common sense by the operator is essential to minimize the hazards of overloading, slipping, obstructions in the path of travel, or the use of equipment in operations for which it is not intended or designed. Listed below are a few suggestions that should be followed in the operation of this vehicle.

WARNING

Do not inhale exhaust gases. They contain carbon monoxide, a colorless, odorless gas that can kill. Carbon monoxide is not always easily detected. Do not run the engine in a closed area, such as a garage. If the vehicle is stopped in an open area with the engine running for more than a short period, adjust the ventilation system to force fresh, outside air into the vehicle.

- (1) The operator should be qualified and drive in accordance with safety rules.
- (2) If the vehicle does not operate properly, report to proper authority. A minor adjustment now may save a major repair later.
- (3) Avoid sudden stops or starts. When backing up, check for obstructions or personnel in the path of the vehicle before moving.
- (4) Drive carefully at all times. Exercise caution at cross aisles, sounding horn for safety.
- (5) Do not allow riders on exterior of vehicle.
- (6) Operate the vehicle at a safe distance behind other vehicles.
- (7) Do not operate vehicle with wet or greasy hands.

- (8) Observe flightline traffic rules in the operation of the vehicle.
- (9) Drive carefully on wet or slippery surfaces.
- (10) Keep feet within perimeter of floor board.
- (11) Observe the Operating Instructions and Preventive Maintenance Instructions given in this manual.
- (12) Avoid overloading the vehicle — this is a hazardous practice, for the operator as well as the equipment. Overloading shortens the life of the vehicle and increases maintenance costs.

WARNING

Never remove or bypass grounding prong. Failure to comply can result in personal injury or death from electrocution.

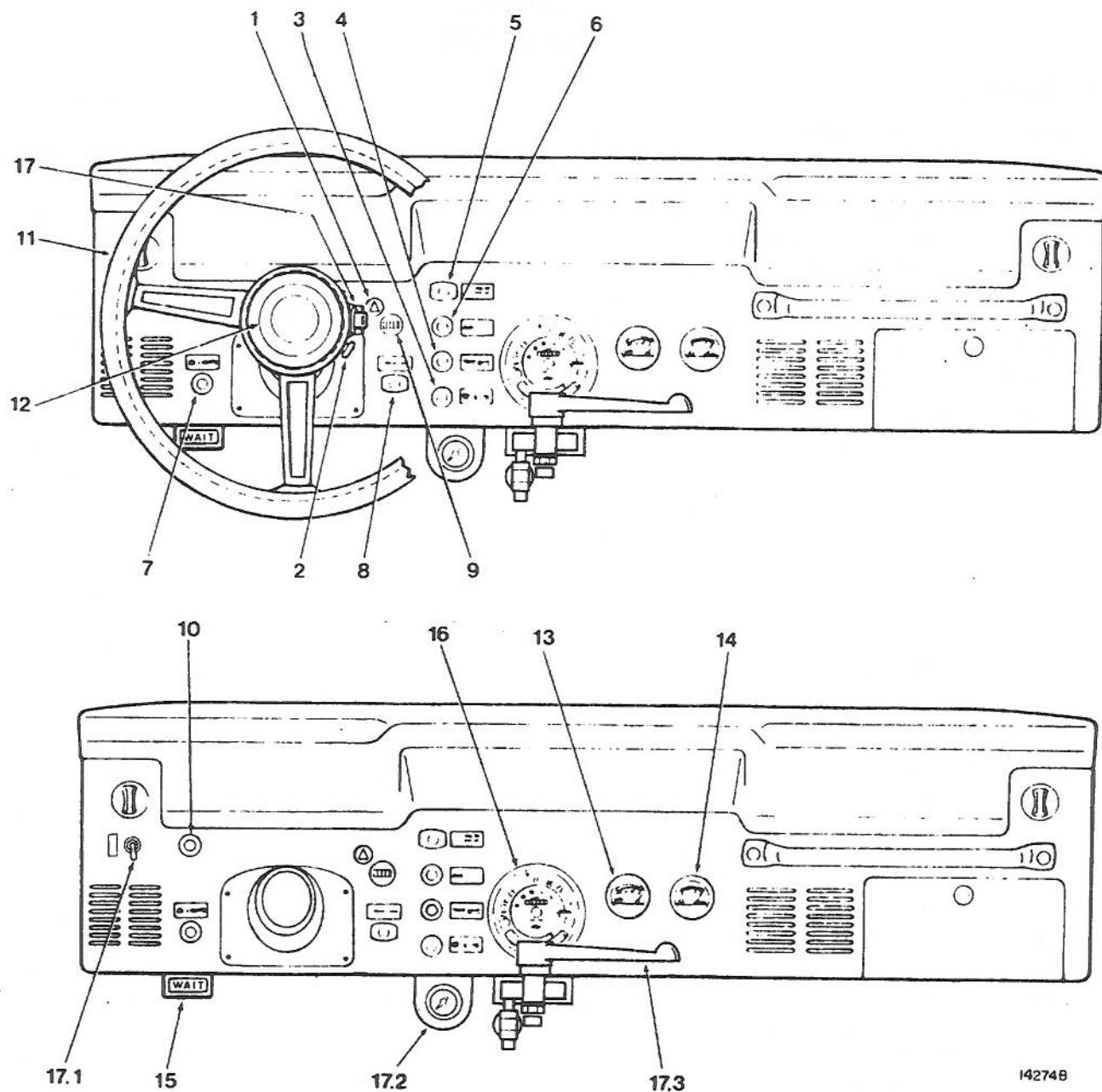
- (13) Use caution when plugging in the winterization system. Do not allow body to come into contact with 115 VAC system. Be sure heavy duty extension cord and 115 VAC receptacles are completely dry before connecting system. Make sure system is disconnected before moving vehicle.

2-3 PRINCIPLES OF OPERATION.

This vehicle provides a means for towing trailers, ground support equipment and other wheeled loads. The vehicle engine provides power for movement of the tractor and towing operations involving loads of up to 40,000 pounds with a drawbar pull of up to 4000 pounds. Torque generated by the engine is multiplied by the torque converter as required in the lower speed ranges when the engine is under load. The automatic transmission combines two multiple disc clutches, two bands and actuating servos, an overrunning clutch and two planetary gear sets to provide three forward gear ratios, neutral and one reverse ratio.

Drive torque is transmitted through the transmission output shaft to the transfer case input gear. The transfer case is a chain drive unit which locks the vehicle into a low gear range providing a reduction ratio of 2.61 to 1.

Torque is further transmitted from the transfer case through a tubular propeller shaft to the rear axle. A splined slip yoke is used at one end of the propeller shaft to compensate for changes in shaft length caused by suspension spring movement.



- | | | |
|--|---|-------------------------|
| 1. Emergency Flasher Indicator Light | 10. Work Light Switch | 17.1 Tank Heater Switch |
| 2. Emergency Flasher | 11. Steering Wheel | 17.2 Air Pressure Gauge |
| 3. Defroster Switch | 12. Horn | 17.3 Air Valve |
| 4. Temperature Control | 13. Voltmeter | |
| 5. Fan Speed Control | 14. Oil Pressure Gauge | |
| 6. Fresh Air Control | 15. Glow Plug Wait Light | |
| 7. Headlight Switch | 16. Instruments Cluster (Speedometer, Odometer, Fuel Level, Engine Temperature Gauge) | |
| 8. Windshield Wiper and Washer Control | 17. Key Switch | |
| 9. Hour Meter | | |

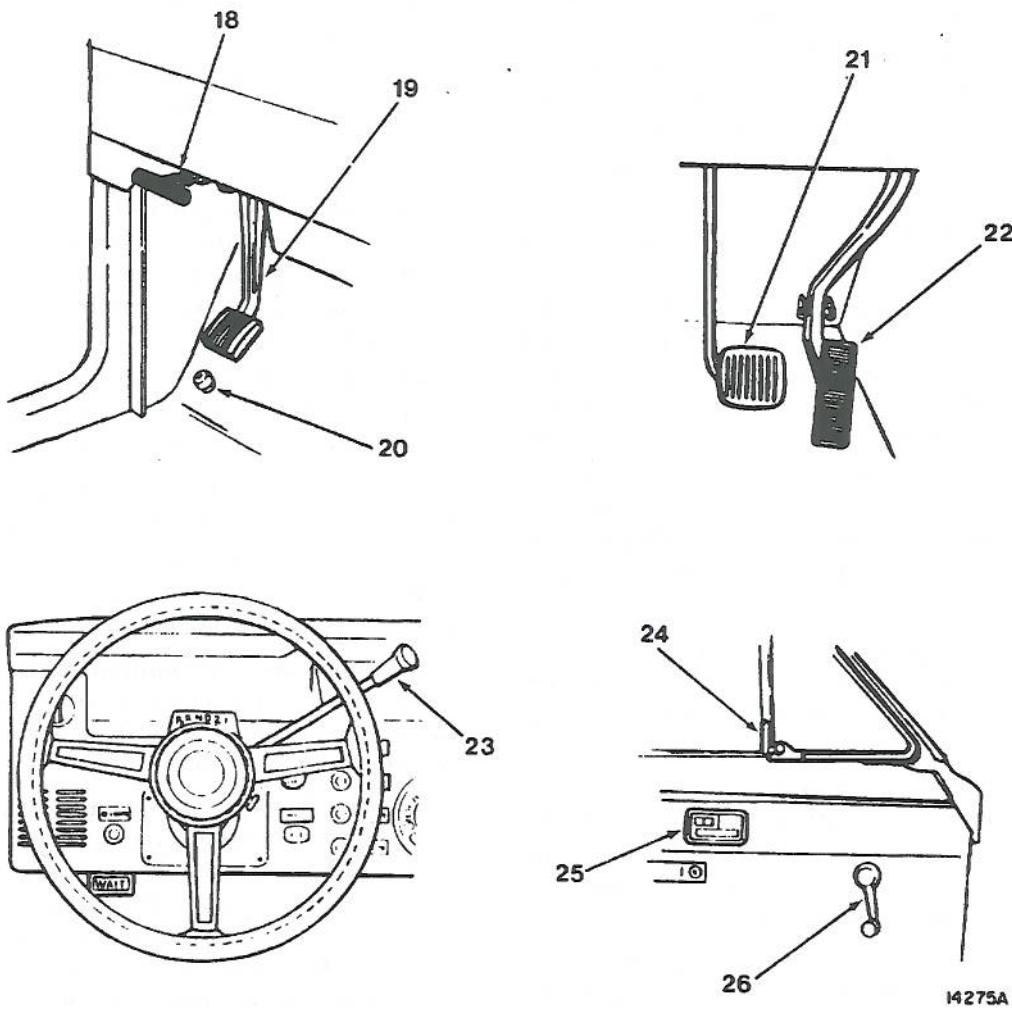
*Figure 2-1. Tractor Controls and Instruments
(Sheet 1 of 2)*

2-4 CONTROLS AND INSTRUMENTS.

Operation of this vehicle is very much like a conventional diesel truck. The vehicle is equipped with hydraulic power steering, power brakes, and a three-speed automatic transmission. Figure 2-1 shows all the vehicle controls and instruments. The following paragraphs discuss all items the operator will need to know for safe and efficient operation of the vehicle.

2-4.1 Equipment Familiarization.

2-4.1.1 *Switch.* The switch is located on the right side of the steering column. To operate the switch, insert the square-head key fully and rotate to one of the five positions: ACCESSORY, LOCK, OFF, ON, or START.



- 18. Parking Brake Release Handle
- 19. Parking Brake
- 20. Headlight Dimmer Switch
- 21. Brake
- 22. Accelerator Pedal

- 23. Shifter
- 24. Vent Handle
- 25. Door Handle
- 26. Window Handle

*Figure 2-1. Tractor Controls and Instruments
(Sheet 2 of 2)*

WARNING

Do not turn key to LOCK position while vehicle is moving. Loss of steering control could result.

CAUTION

Do not attempt to move the shifter lever out of PARK before turning key to ON position to release steering lock. Damage to steering column or shifter may result.

The LOCK position locks the switch, prevents normal steering wheel operation and locks the shift controls. This is the normal parking position.

The ON position unlocks the steering wheel and automatic transmission shift controls. The ON position connects battery power to ignition and electrical systems. This is the normal run position.

The START position engages the starter motor. This position is spring-loaded and will return to the ON position when the key is released. The ACCESSORY position connects battery power to electrical accessories when engine is not running. Key must be turned counter-clockwise to engage the position.

2.4.1.2 Automatic Transmission. The transmission has six positions: P for PARK, R for REVERSE, N for NEUTRAL, D for DRIVE, 2 for DRIVE 2 and 1 for DRIVE 1.

2.4.1.3 Power Steering. The steering wheel is located on the left side of the vehicle. Steering effort is greatly reduced by the engine-driven power steering pump.

2.4.1.4 Brakes. The brake pedal is located on the floor, immediately to the left of the accelerator, and the parking brake is located on the far left side. The parking brake release handle is located above the parking brake pedal, under the dash panel.

2.4.1.5 Accelerator. The accelerator pedal is located on the floor on the right of the operator's side of the vehicle.

2.4.1.6 Seat Belts. Three lap belts are located on the occupant seats.

2.4.2 Gauges and Instruments. Gauges and instruments located in the operator's compartment provide information concerning the performance, operation and control of vehicle.

2.4.2.1 Brake Warning Light. The brake warning light is located on the instrument cluster on the dash panel and illuminates when there is a loss or

difference in hydraulic pressure or to indicate that the parking brake is on. It also illuminates when the ignition switch is turned to the START position.

2.4.2.2 Oil Pressure Gauge. This gauge indicates oil pressure, but not oil level, and is located on the right side of the instrument panel. Normal oil pressure reading for low-to-moderate rpm is 20 to 60 psi and for high rpm is 50 to 60 psi.

2.4.2.3 Voltmeter. The voltmeter is located on the right side of the instrument panel, just to the left of the oil pressure gauge. This gauge indicates available battery voltage and charging system operation. Normal voltmeter reading is between 12 and 15 volts.

2.4.2.4 Instrument Cluster. The instrument cluster is located to the right of the steering column and contains the speedometer, fuel gauge, temperature gauge, turn signal, hazard warning flasher indicators, headlight high beam indicators, brake warning light and odometer.

2.4.2.5 Hour Meter. The hour meter is located to the right of the key switch. It is activated by the ignition switch and records actual vehicle operating time.

2.4.2.6 Air Pressure Gauge. This gauge indicates air pressure and is located below the instrument panel.

2.4.2.7 Low Air Buffer. The low air buffer is located to the right of the air valve and sounds an audible warning when the air pressure drops too low.

2.4.3 Supplemental Equipment Operation. The following paragraphs describe how to operate various light controls, horn, windshield wipers, cab climate controls, and air brakes.

2.4.3.1 Light. Headlights, parking lights and interior lights, including dome light, are controlled by a pull switch located on the left side of the instrument panel. All lights are off when the switch is completely depressed; parking lights, instrument lights, and tail lights come on when the switch is pulled out one detent; headlights, instrument lights and tail lights are turned on when switch is pulled out completely (or two detents). Instrument lights may be adjusted by rotating the pull switch. The dome light is turned on by rotating the pull switch completely clockwise, past the detent.

2.4.3.2 Horn. The horn button is located in the center of the steering wheel.

2.4.3.3 Turn Signal Lever. The turn signal lever is located on the left side of the steering column.

2-4.3.4 Hazard Warning Flasher. The hazard warning flasher button is located on the steering column right side. Pressing it actuates all four turning signals. Pulling out on the button turns off the flashers.

2-4.3.5 Backup Lights. The backup lights operate when the transmission select lever is placed in reverse with the ignition switch ON.

2-4.3.6 Windshield Wipers/Washers. The switch controlling the windshield wipers and washer is located immediately to the right of the steering column. To operate the two-speed wipers, turn the control knob clockwise. To operate the washer feature, depress the control knob and release.

CAUTION

Do not operate the fan with the air control knob pushed in or fan motor may overheat and be damaged.

2-4.3.7 Heating and Ventilation Controls. The heating and ventilation controls are located to the left of the instrument cluster. The fan switch is operated by turning clockwise and controls the blower speeds. The air control knob is operated by pulling. The first, position selects heat and the second position selects fresh air ventilation. The temperature control knob regulates the air temperature. The defroster knob directs air to the windshield when pulled.

2-4.3.8 Dimmer Switch. The dimmer switch is located on the cab floor beneath the parking brake lever and controls the selection of high or low headlamp beams.

2-4.3.9 Air Valve. The air valve is located in front of the instrument panel and controls air flow to the left hand side gladhand couplings.

2-4.3.10 Air Tank Heater Switch. The toggle switch that controls the heaters attached to the air tanks is located on the left side of the instrument panel.

2-5 STARTING THE EQUIPMENT.

The following paragraphs describe prestart checks, engine starting, and post-start checks.

NOTE

This checklist does not provide performance of any services required by Table 3-2, Operator's Inspection Table.

2-5.1 Prestart Checks. The following checks should be performed prior to engine start.

- (1) Check beneath vehicle for leakage of fuel, oil, hydraulic fluid or water.
- (2) Check for adequate oil, fuel and coolant level.

- (3) Inspect tires for damage, foreign objects and tire pressure.
- (4) Check for fraying and tension of belts, alternator and fan, and engine driven hydraulic pumps.
- (5) Check operation of horn and lights.
- (6) Inspect and service vehicle as required by the Operator's Daily Inspection Table.

2-5.2 Starting Engine. The following steps should be followed to start the engine.

- (1) Insert key in starting switch.
- (2) Place automatic transmission lever in PARK (P).
- (3) Set parking brake.
- (4) Turn starting switch to ON position and wait until orange WAIT light goes out, signifying the glow plugs have warmed up.

NOTE

Do not pump accelerator prior to engine start.

- (5) Depress accelerator halfway to the floor and hold in that position.

CAUTION

Do not operate starter motor for more than 30 seconds continuously. If engine fails to start after 30 seconds, allow the starter motor to cool for at least two minutes before attempting to start the engine again.

- (6) Turn starting switch to START position and hold until engine starts, then release.

2-5.3 Post-start Checks. The following steps should be performed after engine start, but prior to moving vehicle.

- (1) Check all instruments and controls for correct readings and operation.
- (2) Check reaction of wheel brakes by engaging transmission, allowing vehicle to move forward slowly and then applying brake pedal.
- (3) Record all malfunctions and discrepancies on appropriate form.

2-6 NORMAL OPERATION.

The following paragraphs describe normal vehicle operations, including how to drive and how to tow loads using the vehicle.

WARNING

- Do not coast in NEUTRAL. It is an unsafe practice and it may cause transmission damage.
- Driveshaft(s) must be removed before towing.
- Do not downshift on slippery roads, since engine braking may cause a skid.
- Do not use the PARK position as a substitute for the parking brake. Apply the parking brake fully when parked.

CAUTION

- Do not drive in 1st or 2nd gears at sustained high speeds or damage to transmission may result.
- Do not place the gearshift lever in PARK or DRIVE while moving in REVERSE or transmission damage may result.
- Do not place the gearshift lever in PARK or REVERSE while moving forward or transmission damage may result.
- Do not race the engine before shifting from NEUTRAL or PARK or transmission damage may result.
- Do not race the engine with the brakes on and the vehicle in gear or hold the vehicle on an incline without applying the brakes. This can overheat and damage the transmission.
- Operation of the vehicle is essentially the same as that for any automotive type equipment, all controls and instruments are positioned conveniently for operator's use and in approximately the same location or relationships as that used in an ordinary truck or passenger car. Operators should familiarize themselves with the steering and performance characteristics of the vehicle before attempting to perform any actual towing operations. Sudden starts, stops, and turns are to be avoided, except in cases of emergency.

can be made at any time); 2 - DRIVE 2, for moderate grades and to assist braking on dry pavement or in mud or snow; 1 - DRIVE 1, for hard pulling at low speeds, in mud, sand or snow, or on steep grades. Lift the gearshift lever slightly when shifting. No lift is required for N (NEUTRAL) to D (DRIVE). A safety switch prevents engine starting unless the gear selector is in P (PARK) or N (NEUTRAL). To move the vehicle after engine start, apply the brake and move the shifter to the desired position. During normal driving, the transmission will automatically change gears to meet varying requirements.

2-6.2 Description of Extendable Hitch Function.**2-6.2.1 For Non-nuclear Towing only.**

- a. The rear of the FLTT is equipped with a center-mounted, extendable pintle hook, and hitch assembly (extendable unit). The extendable unit consists of a self-locking, sliding bar that allows the pintle hook backward movement and a lateral swing movement in either direction from the centerline of the tow tractor. This feature facilitates connection of the pintle hook to the lunette or towing eye of the towed load by a single operator, rather than a method requiring two users.
- b. The normal towing position for this extendable unit is in the retracted and straight positions (closed), rather than in the extended and swung positions (open). Once the lunette or towing eye of the towed load is secured in the pintle hook, the extendable unit shall be engaged in the retracted and straight positions (closed) by pulling the tow tractor/trailer assembly forward to straighten the unit and by backing the FLTT rearward to retract the unit.
- c. Once done, the extendable unit is secured in the closed position, and the tow tractor/trailer assembly is ready for the towing exercise. This procedure only applies to the towing of non-nuclear certified loads and equipment.

2-6.2.2 For Nuclear Towing. Nuclear Towing is authorized only when center pintle hook is locked into position, both fully retracted and centered. Positioning and locking of pintle assembly by towing is not authorized. Consult the MNCL for further information on use with nuclear weapons.**2-6.3 Towing Operations.** During towing operations, keep the vehicle in a gear range that will provide adequate torque for negotiation of grades. Vehicle speed must be kept low enough that the vehicle and load can be safely stopped within an assured clear distance. Always check the pintle hook connection to see that the hook is properly engaged with the drawbar lunette eye or coupling. Always check the gladhand connections to be sure they are properly engaged with air lines of towed vehicle. When negotiating turns or operating in areas

where clearances are restricted, always take into consideration the physical size and steering characteristics of the load being towed.

2-7 OPERATION UNDER UNUSUAL CONDITIONS.

The following paragraphs provide information on fluid levels, lubricants, subassemblies and systems that can be adversely affected due to extreme climatic conditions.

2-7.1 Extreme Heat.

2-7.1.1 Cooling System. Check cooling system as follows:

- a. Make sure fan belts are properly adjusted.
- b. Check coolant level frequently, and be sure radiator cap is secure.
- c. Keep exterior of radiator clean and free of foreign matter which might effect circulation of air.

2-7.1.2 Battery. Check electrolyte level daily and maintain at proper levels.

2-7.1.3 Lubrication. Observe instructions in Figure 3-1, Lubrication Chart.

2-7.1.4 Fuel System. Fill fuel tank at end of day to expel moisture which may collect in vapor form inside the tank.

2-7.2 Extreme Cold.

2-7.2.1 Shelter. The vehicle should be sheltered in a closed building with some heat, if possible. If this is not possible, cover with a tarpaulin or similar kind of material.

2-7.2.2 Cooling System. Add proper amount of ethylene glycol antifreeze to cooling system. If antifreeze is not available, drain radiator and cylinder block when ambient temperature is expected to drop below 32°F. Never add water to the cooling system without subsequently checking the antifreeze solution for adequate strength and adding antifreeze if necessary.

2-7.2.3 Electrical System. Check the battery as follows:

- a. Test the specific gravity of the electrolyte in the battery, using a hydrometer. Specific gravity reacting should be between 1.260 and 1.275 at 80°F.
- b. Electrolyte level of battery must be maintained at 112 inch above plates. Do not add water to a battery which has been exposed to cold temperature, except when engine is to be operated immediately.

c. Remove battery and store it in a warm place when shelter for truck is not available. The efficiency of the battery decreases at lower temperatures, and a completely discharged battery will freeze at 20°F.

d. Be sure that wires and cables are in good condition and that all connections are clean, dry and secure.

2-7.2.4 Lubrication. Follow lubrication instructions in Figure 3-1, Lubrication Chart.

2-7.2.5 Fuel system. Use grade of fuel prescribed for the climate and fill fuel tank at the end of the day to expel moisture.

2-7.2.6 Winterization System. During extreme cold this system will heat engine oil, coolant, and battery. To engage the system perform the following:

WARNING

Never remove or bypass grounding prong. Failure to comply can result in personal injury or death from electrocution.

- a. Open receptacle cover at front of vehicle.
- b. Plug heavy duty extension cord into receptacle. Plug other end of extension cord into a 115 VAC grounded outlet.

2-7.3 Humid Climates. In tropical areas, if paint is chipped or scratched, the affected area should be refinished immediately to prevent rapid formation of rust. Remove all loose paint with paint remover, sandpaper or sandblasting equipment. Apply two coats of red lead primer and, when dry, apply finishing coat of paint.

2-7.4 Dusty Conditions. Operators of trucks used in extremely dusty conditions should check the air cleaner daily to ensure that excessive buildup of dust or dirt, which would restrict air flow, is not permitted. Lubrication service intervals for all items should be reduced to one-half the normal period, or as short as 50 hours, depending upon the severity of the service.

2-8 STOPPING THE EQUIPMENT.

The following paragraphs describe how to park and stop the vehicle, including any post-operative checks.

- a. **Parking vehicle.** To park the vehicle, perform the following procedures:

- (1) Remove foot from accelerator pedal.
- (2) Apply gradual foot pressure to the brake pedal to bring the vehicle to a smooth, safe stop. Avoid sudden application of full braking effort, except in cases of emergency.
- (3) Shift to PARK and apply parking brake.

CAUTION

If the engine has been operating at, or near, full load, it should be allowed to run at fast idle for several minutes after the load is removed before being stopped. This allows internal engine temperatures to equalize.

- b. Engine shutdown. Turn ignition switch to OFF to shut down engine.
- c. Post-operative checks. When shutting down the vehicle for overnight or weekend storage, perform the following procedures:
 - (1) Make certain that lights, heater and all electrical accessories are turned OFF. Engage parking brake.
 - (2) Close all cab windows.
 - (3) Fill fuel tank.
 - (4) If ambient temperatures near 0°F are anticipated, plug in winterization system to a 115 VAC supply to improve starting after vehicle has been parked overnight.

Chapter 3

OPERATOR INSPECTION, MAINTENANCE AND LUBRICATION

3-1 INTRODUCTION.

This section provides instructions for troubleshooting, inspecting, maintaining and servicing the vehicle. All procedures shall be performed by operating personnel. All maintenance and servicing must be performed at the intervals specified for optimum vehicle performance and minimum downtime.

3-2 TROUBLESHOOTING.

Refer to table 3-1 for assistance in diagnosing and correcting malfunctions that occur during normal operations. This troubleshooting chart provides information on the probable causes and remedial action required for various service troubles. Troubles that may be observed by the operator, but considered beyond his scope of maintenance, will note, "Refer to maintenance."

Table 3-1. Operator's Troubleshooting Table

Trouble	Probable Cause	Checkout Procedure and Remedial Action
Engine		
Engine will not start.	<ol style="list-style-type: none"> 1. Out of fuel. 2. Air in fuel system. 3. Broken fuel line. 4. Defective fuel pump. 	<ol style="list-style-type: none"> 1. Check fuel level. Add fuel. 2. Refer to maintenance. 3. Check for leakage. Refer to maintenance. 4. Refer to maintenance.
Hard starting due to low starting rpm.	<ol style="list-style-type: none"> 1. Loose or corroded, shorted battery connections. 2. Rundown battery(s). 3. Low ambient temperature. 4. Loose or corroded starter wiring connections. 5. Starter dragging (excessive amperage draw). 	<ol style="list-style-type: none"> 1. Clean and tighten terminals. 2. Refer to maintenance. 3. Cold climate starting procedures. 4. Refer to maintenance. 5. Refer to maintenance for repair.
Low lubricating oil pressure (engine at operating temperature).	<ol style="list-style-type: none"> 1. Low oil level. 2. Oil bypassing oil cooler. 3. Faulty pressure gauge. 4. Faulty pressure sender. 	<ol style="list-style-type: none"> 1. Refill. 2. Refer to maintenance. (Turn engine OFF.) 3. Refer to maintenance. (Turn engine OFF.) 4. Refer to maintenance. (Turn engine OFF.)

Table 3-1. Operator's Troubleshooting Table-Continued

Trouble	Probable Cause	Checkout Procedure and Remedial Action
Engine-Continued		
Low lubricating oil pressure (engine at operating temperature)-cont.	5. Oil filter clogged.	5. Refer to maintenance. (Turn engine OFF.)
Uneven running and/or frequent stalling.	1. No fuel or insufficient fuel. 2. Coolant temperature below normal. 3. Dirty fuel filter. 4. Governor instability. 5. Moisture in fuel due to condensation. 6. Dirty air cleaner.	1. Fill fuel tank. 2. Check cooling system. 3. Refer to maintenance. 4. Refer to maintenance. 5. Refer to maintenance. 6. Refer to maintenance.
Lack of power.	1. Incorrect fuel. 2. Incorrect governor adjustment. 3. Air cleaner damaged, dirty, or clogged. 4. Air cleaner intake obstructed.	1. Refer to maintenance. 2. Refer to maintenance. 3. Refer to maintenance. 4. Refer to maintenance.
Cooling Systems		
Engine coolant overheating.	1. Scale or deposits in cooling system. 2. Radiator clogged. 3. Loose fan belt. 4. Low coolant level. 5. Damaged coolant hose. 6. Damaged or inoperative thermostat. 7. Water pump failure.	1. Refer to maintenance. 2. Refer to maintenance. 3. Refer to maintenance. 4. Fill cooling system. 5. Refer to maintenance. 6. Refer to maintenance. 7. Refer to maintenance.

Table 3-1. Operator's Troubleshooting Table-Continued

Trouble	Probable Cause	Checkout Procedure and Remedial Action
Cooling System-Continued		
Engine coolant too cool.	1. Thermostat stuck open.	1. Refer to maintenance.
Transmission		
No drive in one range.	1. Low oil level. 2. Manual selector lever not properly positioned. 3. Driveline failure.	1. Fill to proper level. 2. Refer to maintenance. 3. Refer to maintenance.
Steering System		
Wheel steering hard in one or both directions (engine running).	1. Steering gear sluggish.	1. Refer to maintenance.
Erratic power steering or no power steering at all.	1. Defective power steering gear. 2. Defective pump assembly. 3. Low fluid level	1. Refer to maintenance. 2. Refer to maintenance. 3. Fill to proper level.
Excessive backlash in steering system.	1. Excessive backlash in steering mechanism. 2. Worn or damaged steering components.	1. Refer to maintenance. 2. Refer to maintenance.
Brake System		
Brakes dragging.	1. Defective brake shoe return spring. 2. Loose or damaged wheel bearing. 3. Linings improperly adjusted. 4. Parking brake improperly adjusted.	1. Refer to maintenance. 2. Refer to maintenance. 3. Refer to maintenance. 4. Refer to maintenance.
Brakes "grab", vehicle pulls to one side on brake application.	1. Improperly inflated tires. 2. Linings grease soaked.	1. Inflate to correct pressure. 2. Refer to maintenance.

Table 3-1. Operator's Troubleshooting Table-Continued

Trouble	Probable Cause	Checkout Procedure and Remedial Action
Brake System-Continued		
Brakes "grab", vehicle pulls to one side on brake application-cont.	3. Linings improperly adjusted.	3. Refer to maintenance.
Erratic, uneven braking.	1. Soft tire 2. Improper adjustment.	1. Inflate to correct pressure. 2. Refer to maintenance.
Slow brake application.	1. Low hydraulic pressure. 2. Brake improperly adjusted.	1. Refer to maintenance. 2. Refer to maintenance.
Excessive pedal travel.	1. Low hydraulic pressure.	1. Refer to maintenance.
Brakes squeal on application.	1. Glazed or dirty linings. 2. Lining worn to rivet heads.	1. Refer to maintenance. 2. Refer to maintenance.
Electrical System		
Batteries discharge rapidly.	1. Alternator, regulator or wiring faulty. 2. Loose or corroded battery terminals. 3. Voltage regulator not functioning properly. 4. Short circuit in the electrical system. 5. Battery cable or wiring resistance too high. 6. Defective cell in battery.	1. Refer to maintenance. 2. Refer to maintenance. 3. Refer to maintenance. 4. Refer to maintenance. 5. Refer to maintenance. 6. Refer to maintenance.
No battery voltage.	1. Battery discharged. 2. Circuit breaker open. 3. Disconnected battery cable.	1. Refer to maintenance. 2. Refer to maintenance 3. Refer to maintenance.
Improper system voltage.	1. Alternator belt slipping. 2. Defective voltage regulator.	1. Refer to maintenance. 2. Refer to maintenance.

Table 3-1. Operator's Troubleshooting Table-Continued

Trouble	Probable Cause	Checkout Procedure and Remedial Action
Electrical System-Continued		
Improper system voltage- cont.	3. Insufficient alternator output.	3. Refer to maintenance.
Lights dim.	1. Lower battery voltage. 2. Poor electrical connections. 3. Defective alternator.	1. Refer to maintenance. 2. Refer to maintenance. 3. Refer to maintenance.
Lights inoperative.	1. Defective bulb. 2. Faulty circuit breaker. 3. Broken lead. 4. Defective switch.	1. Refer to maintenance. 2. Refer to maintenance. 3. Refer to maintenance. 4. Refer to maintenance.
Frequent lamp failures.	1. Improper electrical system voltage. 2. Poor battery connections.	1. Refer to maintenance. 2. Refer to maintenance.
Windshield Wipers		
No action.	1. No electrical connection. 2. Defective motor. 3. Defective switch.	1. Connect connector. 2. Refer to maintenance. 3. Refer to maintenance.
Drive Shaft		
Noisy drive line.	1. Out of balance. 2. Badly worn parts.	1. Refer to maintenance. 2. Refer to maintenance.
Driveline vibration.	1. Yokes out of line. 2. Shafts out of balance.	1. Refer to maintenance. 2. Refer to maintenance.

Table 3-1. Operator's Troubleshooting Table-Continued

Trouble	Probable Cause	Checkout Procedure and Remedial Action
Axles		
Noise from drive unit.	1. Lubricant not to specified level. 2. Incorrect lubricant.	1. Refer to maintenance. 2. Refer to maintenance.
Lubricant leaks through axle shafts.	1. Incorrect kind and weight of lubricant. 2. Lubricant above specified level.	1. Refer to maintenance. 2. Refer to maintenance.
Excessive tire wear.	1. Improper tire inflation. 2. Incorrect toe-in.	1. Correct. 2. Refer to maintenance.
Air System		
No air pressure at gladhand couplings.	1. Air tank(s) drain valve(s) open. 2. Air line broken or leaking. 3. Air governor improperly adjusted or defective. 4. Air compressor drive belt loose or broken. 5. Defective pop-off relief valve. 6. Defective air compressor.	1. Close drain valve(s). 2. Refer to maintenance. 3. Refer to maintenance. 4. Refer to maintenance. 5. Refer to maintenance. 6. Refer to maintenance.
No air pressure at service gladhand couplings.	1. Air line broken or leaking. 2. Defective air valve.	1. Refer to maintenance. 2. Refer to maintenance.
Air compressor fails to maintain air supply or pressure.	1. Air filter dirty. 2. Drive belt slipping. 3. System leaking. 4. Defective air compressor. 5. Defective air pressure gauge.	1. Refer to maintenance. 2. Refer to maintenance. 3. Refer to maintenance. 4. Refer to maintenance. 5. Refer to maintenance.

Table 3-1. Operator's Troubleshooting Table-Continued

Trouble	Probable Cause	Checkout Procedure and Remedial Action
Air System-Continued		
Air compressor noisy.	1. Loose drive belt. 2. Loose drive pulley. 3. Loose idler pulley. 4. Defective air compressor.	1. Refer to maintenance. 2. Refer to maintenance. 3. Refer to maintenance. 4. Refer to maintenance.
Winterization System		
System inoperative.	1. Defective fuse. 2. Defective extension cable. 3. Defective wiring. 4. Defective coolant heater, oil heater, or battery warmer.	1. Refer to maintenance. 2. Refer to maintenance. 3. Refer to maintenance. 4. Refer to maintenance.

3-3 OPERATOR INSPECTION.

All periodic inspections to be performed by the operator are listed in table 3-2. Intervals are based on normal conditions. These intervals should be adjusted for extreme climate conditions. Any defect or substandard condition revealed by the periodic inspection shall be reported immediately and remedied to ensure readiness of the vehicle and minimum downtime.

3-4 OPERATOR MAINTENANCE AND SERVICING.

Operator maintenance is limited to those items to be performed on a daily basis.

3.4.1 Lubrication. Figure 3-1 lists all items rerequiring periodic lubrication and the types of lubricants required. This information is presented by use of symbols on the chart which are identified and explained in the lubricant key. Details for items requiring supplemental information can be found under appropriate paragraph headings.

NOTE

Lubrication intervals given in the lubrication chart are for operating in normal climatic conditions and must be shortened accordingly when operating under conditions of extreme heat, cold, dust, or humidity.

3-4.2 Battery Maintenance. In order for the battery to give maximum service, it must be cared for according to the following instructions.

WARNING

Do not service the battery without wearing safety glasses, rubber gloves and protective clothing. Battery fluid contains sulfuric acid and must be kept away from eyes, skin, clothing and vehicle painted surfaces. If acid contacts any of these, flush immediately with large amounts of water. Get medical attention if acid contacts skin or eyes.

Batteries produce hydrogen gas and can explode and cause serious bodily injury. Don't smoke while checking or servicing the battery. Keep open flames or sparks away from battery filler caps because explosive gas is always present.

Do not allow tools or metal objects to contact the battery posts and the vehicle at the same time. Disconnect the battery negative cable when checking or servicing the battery.

Table 3-2. Operator's Inspection Table

Daily Inspection (When Used)

AXLES

- Check differential for leaks.
- Check hub and flange for leaks.

BRAKES - SERVICE & PARKING

- Check for proper operation.

CAB AND BODY

- Check operation and general condition of compartment doors.
- Inspect weather seals around cab door for looseness, damage and deterioration.
- Inspect all glass for breaks or discoloration. Check operation of windows.
- Inspect for tears in seat. Check operation of seat adjusting mechanism.

COOLING SYSTEM

- Check coolant level.
- Check coolant color and cleanliness.
- Check all hoses and connections for leaks.

ELECTRICAL

- Battery:**
- Check water level (unless maintenance free).
 - Check terminals and cables for corrosion and tightness.
 - Inspect for chafed or broken wires.
 - Check retaining clips and grommets.
 - Check light assemblies for operation, cracked lenses.
 - Check operation of instruments.
 - Check all terminals and connections for corrosion and tightness.
 - Check alternator operation.

ENGINE

- Check crankcase oil level.
- Check power steering reservoir fluid level.
- Check drive belts for wear or defects.
- Inspect fuel lines and filter for leaks.

TRANSMISSION

- Check oil level.
- Inspect for fluid leaks.

WHEELS AND TIRES

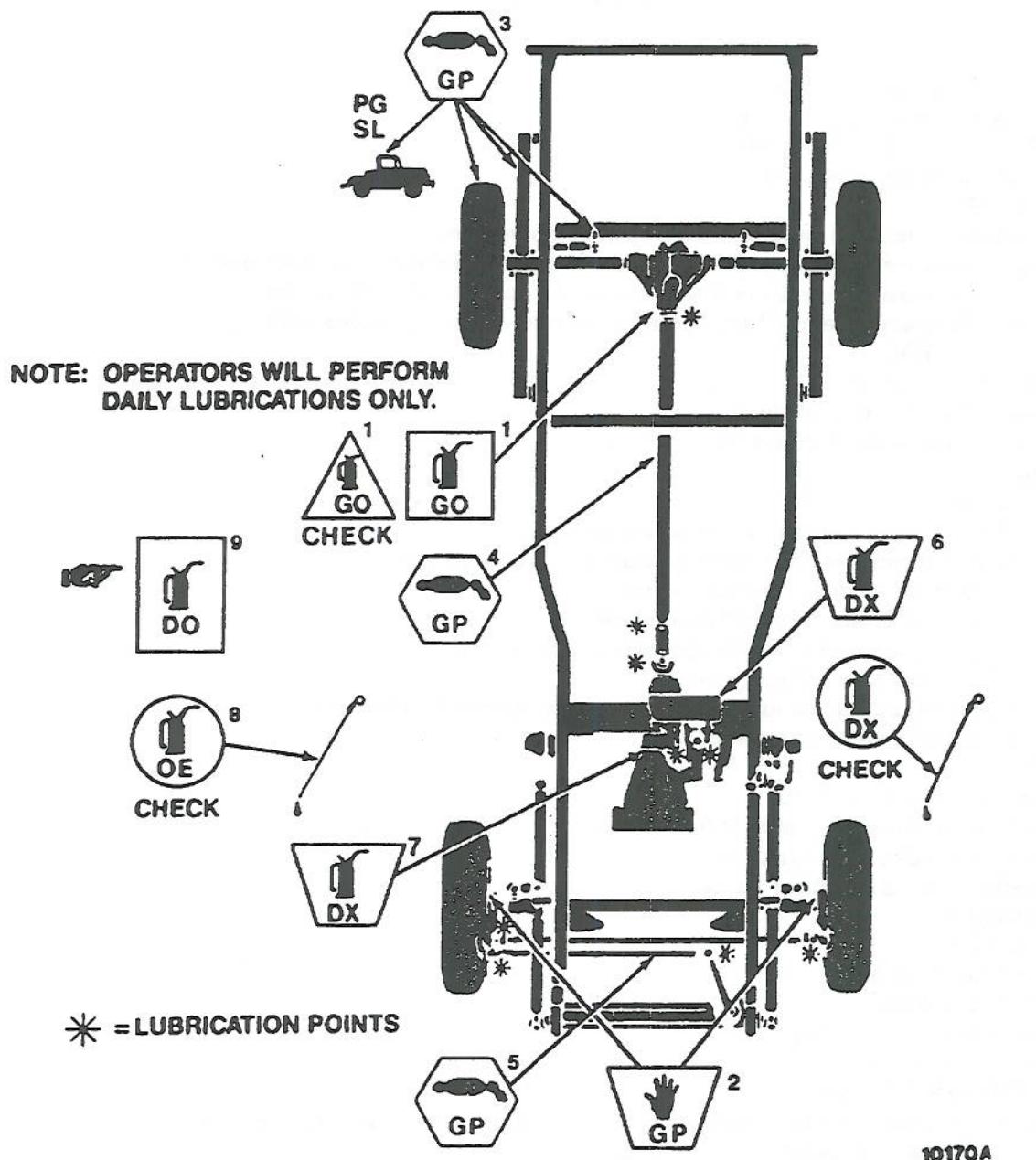
- Check wheel nuts for tightness.
- Check tire condition.

WINTERIZATION SYSTEM

- Inspect extension cable for nicked or burned insulation, or damaged receptacles.
- Check all hoses and connections for leaks.

AIR BRAKE SYSTEM

- Check for proper operation.
- Check gladhands for physical damage.
- Inspect for air leaks.
- Drain air tanks.



1. AXLE DIFFERENTIAL (SEE NOTE 3)
2. FRONT WHEEL BEARING (SEE NOTE 4)
3. BODY COMPONENTS (SEE NOTE 5)
4. PROPELLER SHAFTS (SEE NOTE 7)
5. STEERING LINKAGE (SEE NOTE 6)
6. TRANSFER CASE (SEE NOTE 8)
7. TRANSMISSION (SEE NOTE 9)
8. ENGINE OIL (SEE NOTE 10)
9. INJECTOR PUMP GOVERNOR (SEE NOTE 11)

Lubricant Key

Types Of Lubricants & Symbols

ENGINE OIL, OE CC OR CD	30°C and up	-7°C to +25°C	+5°C to +40°C	-18°C to +10°C
	15W40 or 20W/40		10W30	
DEXRON II, DX	40W	30W	20W20	10W
OIL, GEAR, GO SAE 80W-140	Oil, Gear	Oil, Gear	Oil, Gear	Oil, Gear
LITHIUM-BASED CHASSIS LUBRICANT, GP	Grease, Chassis, General Purpose	Grease, Chassis, General Purpose	Grease, Chassis, General Purpose	Grease, Chassis, General Purpose
3M SPRAY LUBE 8902, SL	Lubricant, Spray	Lubricant, Spray	Lubricant, Spray	Lubricant, Spray
POWDERED GRAPHITE, AMC/JEEP Silicon Lubricant Spray or Light Oil PG	Graphite, Powdered	Graphite, Powdered	Graphite, Powdered	Graphite, Powdered
DIAPHRAGM OIL, DO (Cod Liver Oil or Equivalent)				

INTERVAL KEY						APPLICATION KEY		
							GREASE GUN	

200 HR OR
5000 K OR
3100 MILES DAILY 2500 MILES
OR
3 MONTHS 5000 MILES
OR
6 MONTHS 12,000 MILES
OR
12 MONTHS 30,000 MILES
OR
30 MONTHS

10154A

Figure 3-1. Lubrication Chart (Sheet 2 of 3)

Lubrication Notes

1. Clean the lubrication fittings with dry cleaning solvent, Federal Specification PD680 Type II. Dry before applying lubricant.
2. Intervals specified are for normal operation. The maintenance office may adjust the intervals to compensate for unusual climatic or operating conditions.
3. Check axle differential fluid at 2500 miles or 3 months. Replace differential fluid at 30,000 miles or 30 months.
4. Lubricate every 12,000 miles or 12 months. Replace spindle oil and bearing seals on front wheel bearings (rear wheel bearings do not require periodic or scheduled lubrication).
5. Lubricate body components at 5000 miles or 6 months. Lubricate the following items with the recommended lubricants: hood, glove box door latch and hinge; locks; windshield hinges and holdown knobs.
6. Lubricate propeller shafts at 5000 miles or 6 months. Lubricate sleeve yokes (spline and U-joints).
7. Lubricate steering linkage at 5000 miles or 6 months. Lubricate ball joints. Lubricate every 12 months or 12,000 miles.
8. Check transfer case fluid level at 3 months or 2500 miles. Replace fluid at 1200 miles or 12 months.
9. Replace automatic transmission fluid at every 1200 miles or 12 months.
10. Change engine oil at 250 miles and every 1,000 miles afterward.
11. Lubricate the diaphragm for the governor every 200 hours. Remove the drain plug to remove the old oil, then replace the drain plug. Remove the fill plug and apply a few drops of diaphragm oil (cod liver oil) through the fill port. Replace the fill plug.

*Figure 3-1. Lubrication Chart (Sheet 3 of 3)***WARNING**

Do not attempt to charge or use a booster on a battery with frozen electrolyte. The frozen battery may explode.

- a. Check electrolyte level as follows.

NOTE

Electrolyte level inspection does not apply to maintenance-free batteries.

Uneven filling of cells will offset battery storage capacity and service life.

- (1) Remove battery fill caps and look into each filler well.

NOTE

In freezing weather, add water before driving to assure mixing with acid and to prevent freezing.

- (2) Add distilled water, or drinking water free of high mineral content, to maintain fluid level above battery plates and at the bottom of the filler well ring.

- b. Check specific gravity. Hydrometer readings should be used to determine the battery state of charge. This is particularly true in cold weather, as a partially charged battery may freeze at temperatures up to 20°F.

- (1) Draw in electrolyte, using hydrometer, as shown in figure 3-2.

- (2) Make sure float is free and take specific gravity reading at eye level.

NOTE

Do not add distilled water to electrolyte immediately after charging battery.

- (3) Battery needs charging if specific gravity reads 1.225 (or less) at 75°F. Correct the reading for current temperature using chart in figure 3-2.

- c. Check battery condition. Check condition of battery and cables as follows.

- (1) Check all battery cable connections periodically to make sure they are clean and tight.

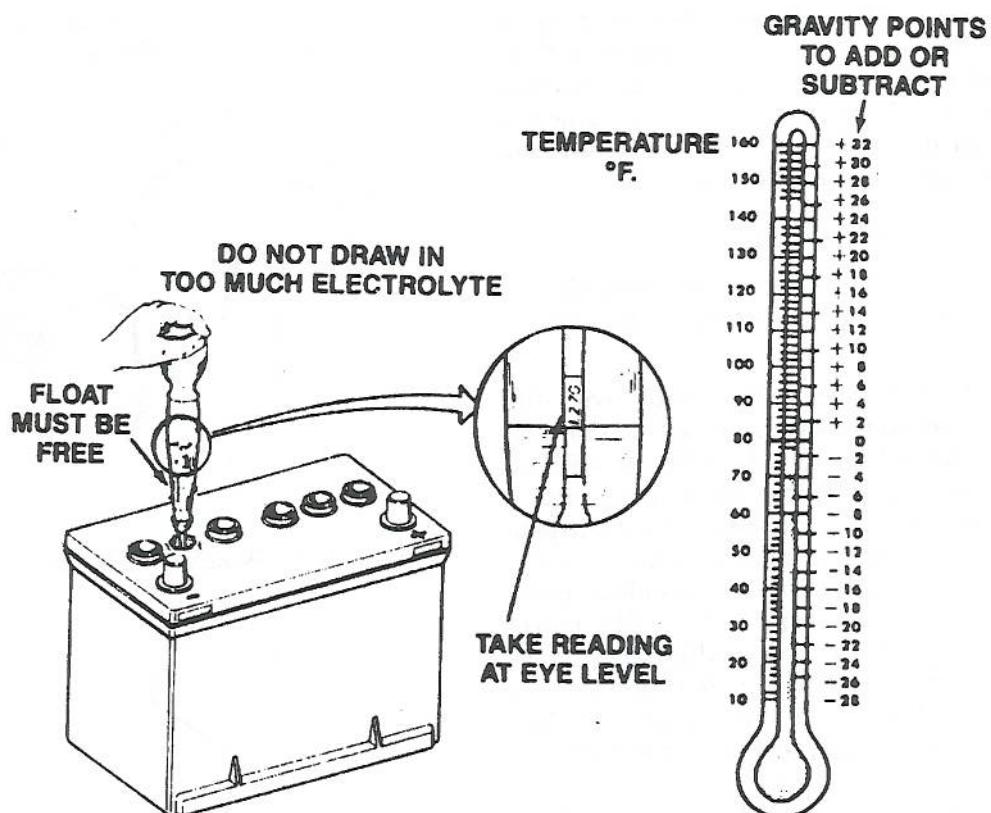
- (2) Remove any corrosion from battery terminals by scrubbing with a solution of baking soda or ammonia and water.

- (3) Clean battery posts with a cleaning tool, as shown in figure 3-3, and clean the inside surfaces of the cable terminals, as shown in figure 3-4.

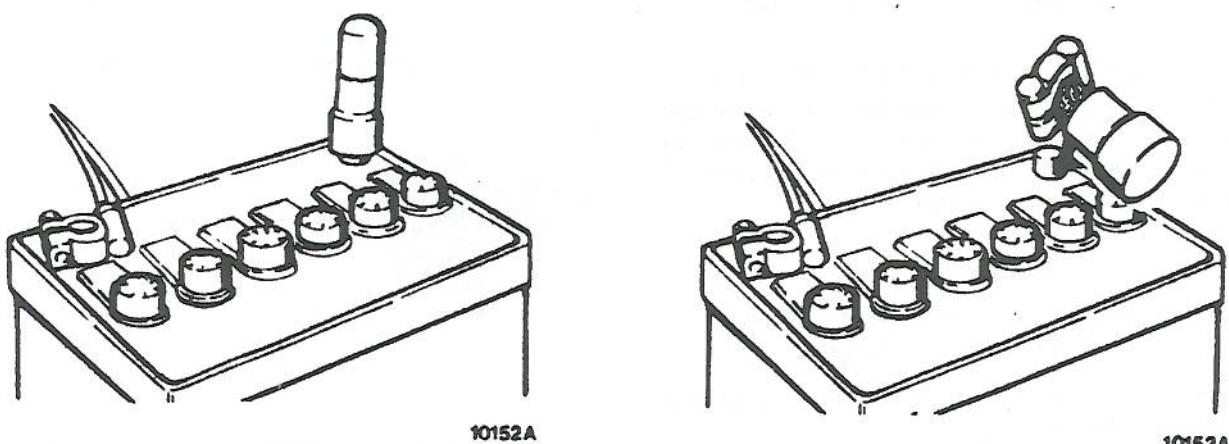
- (4) After cleaning, coat the exterior of the cable terminals with a light film of petroleum jelly to retard further corrosion.

CAUTION

Do not use antifreeze or other solutions in windshield washer fluid reservoir that may damage paint.



10153A

Figure 3-2. Checking Battery Specific Gravity.*Figure 3-3. Cleaning Battery Posts**Figure 3-4. Cleaning Cable Terminals*

3-4.3 Windshield Fluid Level. The windshield washer fluid reservoir, located under the hood (Figure 3-5), must be refilled periodically with water and a washer solvent. In freezing weather, warm the windshield with the defroster before using the washer to prevent icing on the glass.

WARNING

Do not remove the radiator cap when the engine is hot or injury to personnel may occur.

3-4.4 Coolant Level. Check the coolant level, (figure 3-6) at the recovery bottle, not at the radiator. The proper level is between the ADD and FULL marks with the engine at operating temperature. Add a 50/50 mixture of permanent-type antifreeze and water to the bottle, if necessary to raise the level. Do not remove the radiator cap unless necessary. Do not fill the reservoir above the FULL mark. A special radiator cap ensures sealing and allows the normal expansion of coolant to flow to the reservoir when hot and return as the engine cools. Use only the proper cap if replacement is necessary.

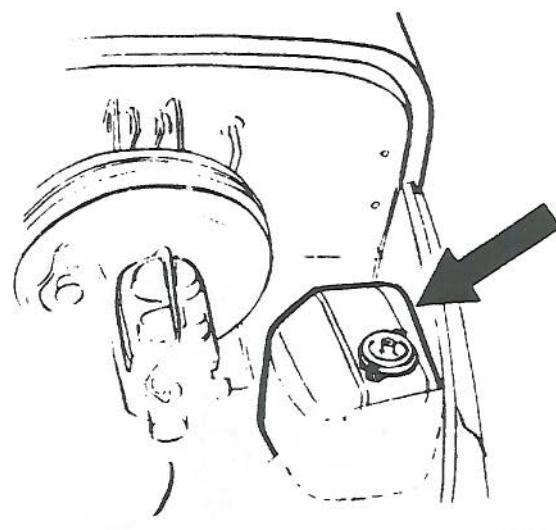
3-4.5 Engine Oil Level. Check oil level daily. Allow the oil to settle a few minutes after stopping the engine, remove the dipstick and wipe it clean. Insert the dipstick in the tube and remove it again. Check the oil level as shown on both sides of the stick (figure 3-7). Oil level should be between the ADD and FULL marks. If the level has dropped to the ADD mark, add one quart (0.95 L) to raise the level to the FULL mark (figure 3-8). Some oil is inevitably used in normal operation. A consumption rate of one quart (0.95 L) per 1000 miles (1600 km) is not excessive.

3-4.6 Transmission Fluid Level. Fluid level should be checked while transmission is at normal operating temperature (figure 3-9). At normal operating temperature, the gauge end of the dipstick will be too hot to handle comfortably.

WARNING

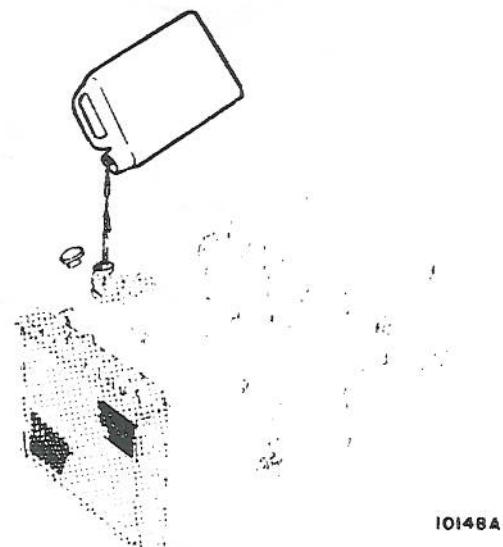
To guard against injury, stay clear of fan and drive belts when engine is running.

- a. Operate engine at idle speed and normal operating temperature.
- b. Place vehicle on level surface, apply parking brake fully and move gearshift lever through all ranges.
- c. Shift to NEUTRAL (not PARK).



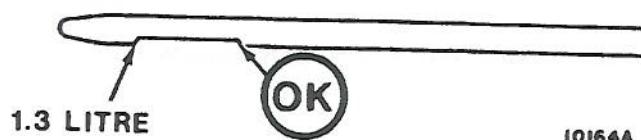
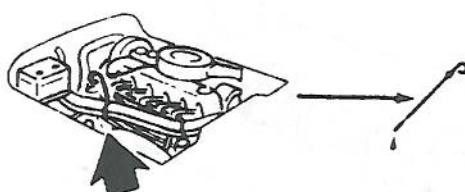
10147A

Figure 3-5. Windshield Washer Fluid Reservoir



10148A

Figure 3-6. Cooling System



10164A

Figure 3-7. Oil Level Indicators

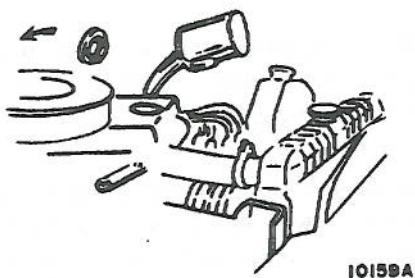


Figure 3-8. Engine Oil

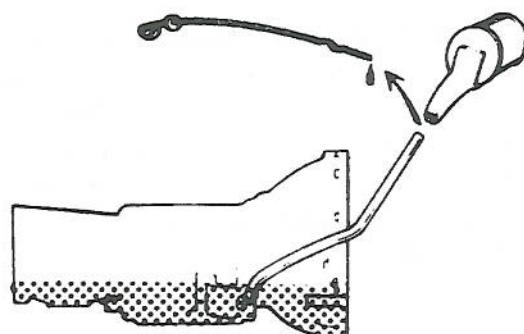
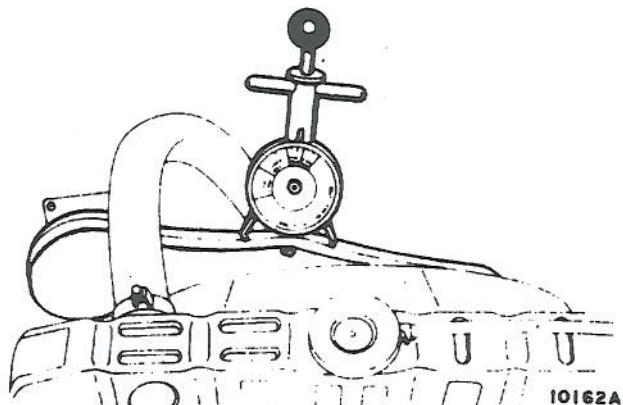
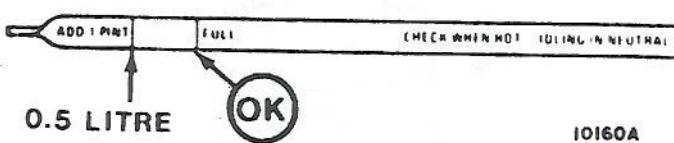
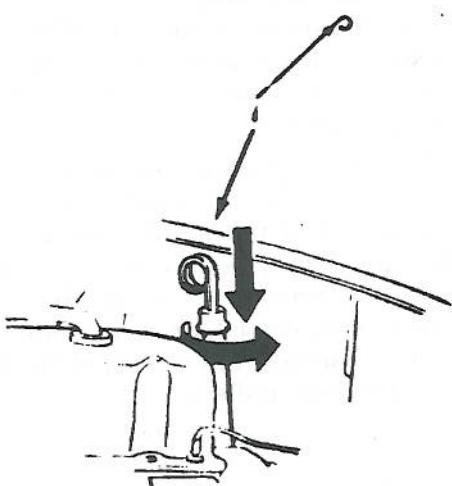


Figure 3-9. Transmission Fluid Level Indicators



- d. Remove dipstick cap. Wipe stick clean and insert fully. Remove dipstick again and note fluid level on both sides. Fluid level should be between the ADD and FULL marks at normal operating temperature. If fluid is low, add required amount of fluid into the dipstick tube as shown in figure 3-10. Do not overfill. Check for leaks.

WARNING

Stay clear of fan and drive belts when rotating or cranking engine.

3-4.7 Drive Belts. With ignition OFF, check tension and condition of belts (figure 3-11). Belts that are worn, cracked, or frayed must be replaced.

3-4.8 Tires and Wheels. Tire life may be greatly lengthened by proper inspection and rotation of tires and wheels.

- a. Perform tire and wheel checks as follows.
 - (1) Check tire wear, using tire wear indicators (figure 3-12), if present, to determine minimum tread level.
 - (2) Check cold tire pressure daily.
 - (3) Check valve stems for proper position and see that all caps are installed.
 - (4) Check condition and tightness of lug nuts.



Figure 3-12. Tire Tread Wear Indicators

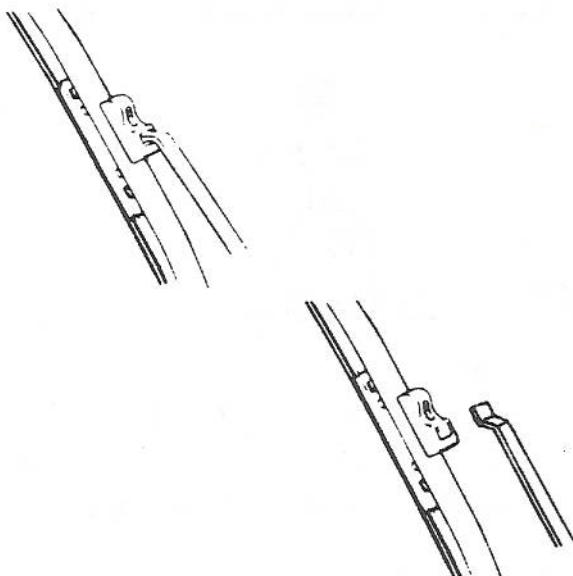
3-4.9 Windshield Wiper Replacement. Washing windshield and rubber wiper element regularly with detergent will extend the life of wiper blades.

- Raise wiper arm (figure 3-13) away from windshield and push blade firmly against tip of arm.
- Hold arm stationary and rotate blade around tip of arm.

NOTE

Rubber element of wiper blade assembly is not replaceable separately.

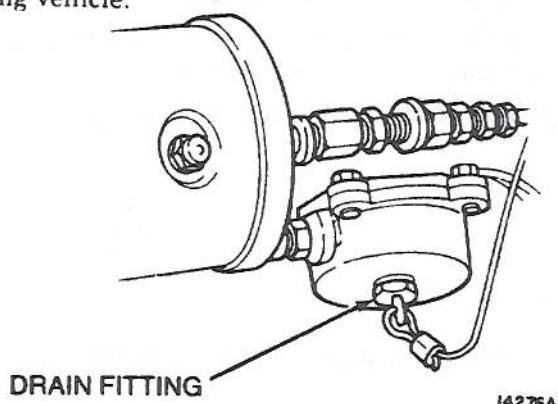
- Install new wiper blade assembly.



10163A

Figure 3-13. Windshield Wiper Blade Replacement

3-4.10 Air Reservoir Check. Remove drain fitting from drain valves (figure 3-14) and allow any accumulated moisture to drain from valves before operating vehicle.



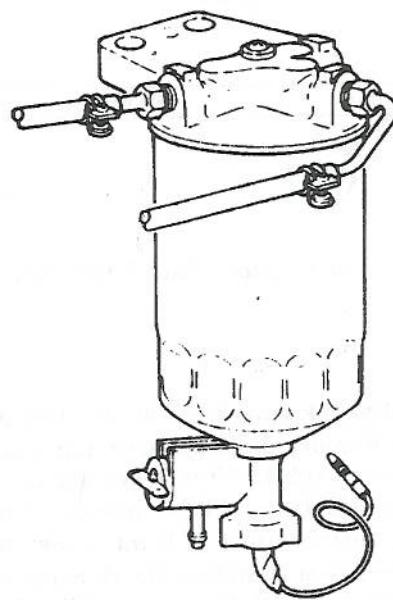
14276A

Figure 3-14. Air Reservoir Check

3-4.11 Water Separator Check. The water separator (figure 3-15) should be checked and drained once a month by turning the drain valve located at the base of the filter.

3-4.12 Exterior Care. Checking and cleaning exterior of vehicle will deter rust and prolong finish. Many chemicals applied to roads and sprayed into the air are highly corrosive and should be removed promptly from vehicle exterior. Extreme weather conditions also adversely affect the vehicle exterior. Steam-cleaning is suggested to remove dirt packed in wheelhousings, bumpers, mufflers, tailpipes and brackets. Avoid spraying steam directly at electrical connectors. If undercoated, repair breaks in the sealer promptly.

3-4.12.1 Paint. Weekly washing with cold, clear water and polishing with a soft cloth or chamois will preserve original finish. Allow metal surfaces to cool before washing. Use care in removing stains and road film to prevent scratching finish. Avoid using abrasive compounds and power buffing that may thin out enamel. Paint scratches should be retouched as soon as discovered.



10144A

Figure 3-15. Water Separator